UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/131,606	01/08/2014	Jenny Adrian Meredith	

CONFIRMATION NO. 4983

141081
MCDONNELL BOEHNEN HULBERT & BERGHOFF LLP/AkzoNobel
300 S. WACKER DRIVE
32ND FLOOR
CHICAGO, IL 60606

POA ACCEPTANCE LETTER

OC000000084161953

Date Mailed: 07/07/2016

NOTICE OF ACCEPTANCE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/29/2016.

The Power of Attorney in this application is accepted. Correspondence in this application will be mailed to the above address as provided by 37 CFR 1.33.

Questions about the contents of this notice and the requirements it sets forth should be directed to the Office of Data Management, Application Assistance Unit, at **(571) 272-4000** or **(571) 272-4200** or **1-888-786-0101**.

/dtvernon/

UNITED STATES PATENT AND TRADEMARK OFFICE

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United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501

CONFIRMATION NO. 4983

POWER OF ATTORNEY NOTICE

OC000000084161861

26646
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

Date Mailed: 07/07/2016

NOTICE REGARDING CHANGE OF POWER OF ATTORNEY

This is in response to the Power of Attorney filed 06/29/2016.

- The Power of Attorney to you in this application has been revoked by the assignee who has intervened as provided by 37 CFR 3.71. Future correspondence will be mailed to the new address of record(37 CFR 1.33).

Questions about the contents of this notice and the
requirements it sets forth should be directed to the Office
of Data Management, Application Assistance Unit, at
(571) 272-4000 or **(571) 272-4200** or **1-888-786-0101**.

/dtvernon/

PTO/AIA/80 (07-12)
Approved for use through 11/30/2014. OMB 0651-0035
U.S. Patent and Trademark Office; U.S DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

POWER OF ATTORNEY TO PROSECUTE APPLICATIONS BEFORE THE USPTO

I hereby revoke all previous powers of attorney given in the application identified in the attached statement under 37 CFR 3.73(c).

I hereby appoint:

☒ Practitioners associated with Customer Number: 141081

OR

☐ Practitioner(s) named below (if more than ten patent practitioners are to be named, then a customer number must be used):

Name	Registration Number	Name	Registration Number

As attorney(s) or agent(s) to represent the undersigned before the United States Patent and Trademark Office (USPTO) in connection with any and all patent applications assigned only to the undersigned according to the USPTO assignment records or assignments documents attached to this form in accordance with 37 CFR 3.73(c).

Please change the correspondence address for the application identified in the attached statement under 37 CFR 3.73(c) to:

☒ The address associated with Customer Number: 141081

OR

☐

Firm or Individual Name			
Address			
City		State	Zip
Country			
Telephone		Email	

Assignee Name and Address: Akzo Nobel Coatings International B.V., Velperweg 76, NL-6824 BM Arnhem, The Netherlands

A copy of this form, together with a statement under 37 CFR 3.73(c) (Form PTO/AIA/96 or equivalent) is required to be Filed in each application in which this form is used. The statement under 37 CFR 3.73(c) may be completed by one of The practitioners appointed in this form, and must identify the application in which this Power of Attorney is to be filed.

SIGNATURE of Assignee of Record
The individual whose signature and title is supplied below is authorized to act on behalf of the assignee

Signature		Date	May 20, 2016
Name	Marieke van Gent	Telephone	+31 88 969 3447
Title	Authorized Signatory		
Signature		Date	May 20, 2016
Name	Petrus Johannes Theodorus Alferink	Telephone	+31 88 969 3447
Title	Authorized Signatory		

This collection of information is required by 37 CFR 1.31, 1.32 and 1.33. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 3 minutes

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT UNDER 37 CFR 3.73(c)

Applicant/Patent Owner: Akzo Nobel Coatings International B.V.

Application No./Patent No.: 14/131,606 Filed/Issue Date: January 08, 2014

Titled: Adhesive System

Akzo Nobel Coatings International B.V., a corporation

(Name of Assignee) (Type of Assignee, e.g., corporation, partnership, university, government agency, etc.)

states that, for the patent application/patent identified above, it is (choose **one** of options 1, 2, 3 or 4 below):

1. ☑ The assignee of the entire right, title, and interest.

2. ☐ An assignee of less than the entire right, title, and interest (check applicable box):

   ☐ The extent (by percentage) of its ownership interest is __________%. Additional Statement(s) by the owners holding the balance of the interest must be submitted to account for 100% of the ownership interest.

   ☐ There are unspecified percentages of ownership. The other parties, including inventors, who together own the entire right, title and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

3. ☐ The assignee of an undivided interest in the entirety (a complete assignment from one of the joint inventors was made). The other parties, including inventors, who together own the entire right, title, and interest are:

   Additional Statement(s) by the owner(s) holding the balance of the interest must be submitted to account for the entire right, title, and interest.

4. ☐ The recipient, via a court proceeding or the like (*e.g.*, bankruptcy, probate), of an undivided interest in the entirety (a complete transfer of ownership interest was made). The certified document(s) showing the transfer is attached.

The interest identified in option 1, 2 or 3 above (not option 4) is evidenced by either (choose **one** of options A or B below):

A. ☑ An assignment from the inventor(s) of the patent application/patent identified above. The assignment was recorded in the United States Patent and Trademark Office at Reel 031920, Frame 0143, or for which a copy thereof is attached.

B. ☐ A chain of title from the inventor(s), of the patent application/patent identified above, to the current assignee as follows:

   1. From: __________ To: __________

      The document was recorded in the United States Patent and Trademark Office at

      Reel __________, Frame __________, or for which a copy thereof is attached.

   2. From: __________ To: __________

      The document was recorded in the United States Patent and Trademark Office at

      Reel __________, Frame __________, or for which a copy thereof is attached.

PTO/AIA/96 (08-12)
Approved for use through 01/31/2013. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

STATEMENT UNDER 37 CFR 3.73(c)

3. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel __________, Frame __________, or for which a copy thereof is attached.

4. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel __________, Frame __________, or for which a copy thereof is attached.

5. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel __________, Frame __________, or for which a copy thereof is attached.

6. From: ______________________ To: ______________________

The document was recorded in the United States Patent and Trademark Office at

Reel __________, Frame __________, or for which a copy thereof is attached.

☐ Additional documents in the chain of title are listed on a supplemental sheet(s).

☑ As required by 37 CFR 3.73(c)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

[NOTE: A separate copy (i.e., a true copy of the original assignment document(s)) must be submitted to Assignment Division in accordance with 37 CFR Part 3, to record the assignment in the records of the USPTO. See MPEP 302.08]

The undersigned (whose title is supplied below) is authorized to act on behalf of the assignee.

/Michael S. Greenfield/	June 29, 2016
Signature	Date
Michael S. Greenfield	37,142
Printed or Typed Name	Title or Registration Number

Privacy Act Statement

The **Privacy Act of 1974 (P.L. 93-579)** requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (*i.e.*, GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Electronic Acknowledgement Receipt

EFS ID:	26212406
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Michael S. Greenfield
Filer Authorized By:	
Attorney Docket Number:	13877/48501
Receipt Date:	29-JUN-2016
Filing Date:	08-JAN-2014
Time Stamp:	18:31:45
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		16-878-WO-US_POA.pdf	681385 126820da58e4a333fe0851a50ff196055d76da0c	yes	4

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Power of Attorney	1	1
	Assignee showing of ownership per 37 CFR 3.73	2	4

Warnings:

The page size in the PDF is too large. The pages should be 8.5 x 11 or A4. If this PDF is submitted, the pages will be resized upon entry into the Image File Wrapper and may affect subsequent processing

Information:

Total Files Size (in bytes):	681385

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	ISSUE DATE	PATENT NO.	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	07/05/2016	9382458	13877/48501	4983

26646 7590 06/15/2016

KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

ISSUE NOTIFICATION

The projected patent number and issue date are specified above.

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)
(application filed on or after May 29, 2000)

The Patent Term Adjustment is 0 day(s). Any patent to issue from the above-identified application will include an indication of the adjustment on the front page.

If a Continued Prosecution Application (CPA) was filed in the above-identified application, the filing date that determines Patent Term Adjustment is the filing date of the most recent CPA.

Applicant will be able to obtain more detailed information by accessing the Patent Application Information Retrieval (PAIR) WEB site (http://pair.uspto.gov).

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Application Assistance Unit (AAU) of the Office of Data Management (ODM) at (571)-272-4200.

APPLICANT(s) (Please see PAIR WEB site http://pair.uspto.gov for additional applicants):

Jenny Adrian Meredith, Arsta, SWEDEN;
Anna Kristina Furberb, Stockholm, SWEDEN;
Eugeniuez Abram, Solna, SWEDEN;
Benyahia Nasli-Bakir, Saltsjo-boo, SWEDEN;
Salme Pirhonen, Sollentuna, SWEDEN;

13877/48501

PTO/SB/47 (03-09)
Approved for use through 05/31/2015. OMB 0651-0016
U.S. Patent and Trademark Office; U. S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

"FEE ADDRESS" INDICATION FORM

Address to:
Mail Stop M Correspondence
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

- OR -

Fax to:
571-273-6500

INSTRUCTIONS: The issue fee must have been paid for application(s) listed on this form. In addition, only an address represented by a Customer Number can be established as the fee address for maintenance fee purposes (hereafter, fee address). A fee address should be established when correspondence related to maintenance fees should be mailed to a different address than the correspondence address for the application. **When to check the first box below**: If you have a Customer Number to represent the fee address. **When to check the second box below**: If you have no Customer Number representing the desired fee address, in which case a completed Request for Customer Number (PTO/SB/125) must be attached to this form. For more information on Customer Numbers, see the Manual of Patent Examining Procedure (MPEP) § 403.

For the following listed application(s), please recognize as the "Fee Address" under the provisions of 37 CFR 1.363 the address associated with:

☑ Customer Number: 000204

Computer Packages Inc.
414 Hungerford Drive
Suite 300
Rockville, Maryland 20850

OR

☐ The attached Request for Customer Number (PTO/SB/125) form.

PATENT NUMBER (if known)	APPLICATION NUMBER
	14/131,606

Completed by (check one):

☐ Applicant/Inventor

/Kevin T. Godlewski/
Signature

☑ Attorney or Agent of record 47,598
(Reg. No.)

Kevin T. Godlewski
Typed or printed name

☐ Assignee of record of the entire interest. See 37 CFR 3.71. Statement under 37 CFR 3.73(b) is enclosed. (Form PTO/SB/96)

212-425-7200
Requester's telephone number

☐ Assignee recorded at Reel ________ Frame________

June 3, 2016
Date

NOTE: Signatures of all the inventors or assignees of record of the entire interest or their representative(s) are required. Submit multiple forms if more that one signature is required, see below*.

☑ *** Total of** 1 **forms are submitted.**

This collection of information is required by 37 CFR 1.363. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 5 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND COMPLETED FORMS TO THIS ADDRESS.
SEND TO: Mail Stop M Correspondence, Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Electronic Patent Application Fee Transmittal

Application Number:	14131606
Filing Date:	08-Jan-2014
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Filer:	Kevin Todd Godlewski/Neil Benowitz
Attorney Docket Number:	13877/48501

Filed as Large Entity

Filing Fees for **U.S. National Stage under 35 USC 371**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Utility Appl Issue Fee	1501	1	960	960

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Miscellaneous:				
		Total in USD ($)		**960**

Electronic Acknowledgement Receipt

EFS ID:	25970106
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Kevin Todd Godlewski/Neil Benowitz
Filer Authorized By:	Kevin Todd Godlewski
Attorney Docket Number:	13877/48501
Receipt Date:	03-JUN-2016
Filing Date:	08-JAN-2014
Time Stamp:	19:19:39
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$960
RAM confirmation Number	5785
Deposit Account	110600
Authorized User	KENYON & KENYON LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 CFR 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 CFR 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 CFR 1.19 (Document supply fees)

Charge any Additional Fees required under 37 CFR 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 CFR 1.21 (Miscellaneous fees and charges)

Charge any Additional Fees required under 37 CFR 1.492(a) (basic national fee only)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Issue Fee Payment (PTO-85B)	13877-48501-IssueFee.pdf	991976 6757892e8ebdc2a4fc48078f089cd6b8e660a5b4	no	1
Warnings:					
Information:					
2	Maintenance Fee Address Change	13877-48501-FeeAddress.pdf	162357 c1047d0b47dbbc03f339ec8589952c89f681e76c	no	1
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	30663 b37eec14716b07abc09a87c08d7640e441b98d40	no	2
Warnings:					
Information:					
		Total Files Size (in bytes):	1184996		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail **Mail Stop ISSUE FEE**
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450
or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26646 7590 03/04/2016
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

Neil H. Benowitz	(Depositor's name)
/Neil H. Benowitz/	(Signature)
June 3, 2016	(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

TITLE OF INVENTION: ADHESIVE SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/06/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
SALVITTI, MICHAEL A	1767	524-843000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).

☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.

☒ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 KENYON & KENYON LLP
2 ____
3 ____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE	(B) RESIDENCE: (CITY and STATE OR COUNTRY)
AKZO NOBEL COATINGS INTERNATIONAL B.V.	ARNHEM, THE NETHERLANDS

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☒ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:

☒ Issue Fee
☐ Publication Fee (No small entity discount permitted)
☐ Advance Order - # of Copies ____

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**

☐ A check is enclosed.
☒ Payment by credit card. ~~Form PTO-2038 is attached~~.
☒ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number 11-0600 (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)

☐ Applicant certifying micro entity status. See 37 CFR 1.29

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

☐ Applicant asserting small entity status. See 37 CFR 1.27

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

☐ Applicant changing to regular undiscounted fee status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature /Kevin T. Godlewski/
Date June 3, 2016
Typed or printed name Kevin T. Godlewski
Registration No. 47,598

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

NOTICE OF ALLOWANCE AND FEE(S) DUE

26646 7590 03/04/2016

KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
SALVITTI, MICHAEL A	
ART UNIT	**PAPER NUMBER**
1767	

DATE MAILED: 03/04/2016

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

TITLE OF INVENTION: ADHESIVE SYSTEM

APPLN. TYPE	ENTITY STATUS	ISSUE FEE DUE	PUBLICATION FEE DUE	PREV. PAID ISSUE FEE	TOTAL FEE(S) DUE	DATE DUE
nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/06/2016

THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT. PROSECUTION ON THE MERITS IS CLOSED. THIS NOTICE OF ALLOWANCE IS NOT A GRANT OF PATENT RIGHTS. THIS APPLICATION IS SUBJECT TO WITHDRAWAL FROM ISSUE AT THE INITIATIVE OF THE OFFICE OR UPON PETITION BY THE APPLICANT. SEE 37 CFR 1.313 AND MPEP 1308.

THE ISSUE FEE AND PUBLICATION FEE (IF REQUIRED) MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED. SEE 35 U.S.C. 151. THE ISSUE FEE DUE INDICATED ABOVE DOES NOT REFLECT A CREDIT FOR ANY PREVIOUSLY PAID ISSUE FEE IN THIS APPLICATION. IF AN ISSUE FEE HAS PREVIOUSLY BEEN PAID IN THIS APPLICATION (AS SHOWN ABOVE), THE RETURN OF PART B OF THIS FORM WILL BE CONSIDERED A REQUEST TO REAPPLY THE PREVIOUSLY PAID ISSUE FEE TOWARD THE ISSUE FEE NOW DUE.

HOW TO REPLY TO THIS NOTICE:

I. Review the ENTITY STATUS shown above. If the ENTITY STATUS is shown as SMALL or MICRO, verify whether entitlement to that entity status still applies.

If the ENTITY STATUS is the same as shown above, pay the TOTAL FEE(S) DUE shown above.

If the ENTITY STATUS is changed from that shown above, on PART B - FEE(S) TRANSMITTAL, complete section number 5 titled "Change in Entity Status (from status indicated above)".

For purposes of this notice, small entity fees are 1/2 the amount of undiscounted fees, and micro entity fees are 1/2 the amount of small entity fees.

II. PART B - FEE(S) TRANSMITTAL, or its equivalent, must be completed and returned to the United States Patent and Trademark Office (USPTO) with your ISSUE FEE and PUBLICATION FEE (if required). If you are charging the fee(s) to your deposit account, section "4b" of Part B - Fee(s) Transmittal should be completed and an extra copy of the form should be submitted. If an equivalent of Part B is filed, a request to reapply a previously paid issue fee must be clearly made, and delays in processing may occur due to the difficulty in recognizing the paper as an equivalent of Part B.

III. All communications regarding this application must give the application number. Please direct all communications prior to issuance to Mail Stop ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

PART B - FEE(S) TRANSMITTAL

Complete and send this form, together with applicable fee(s), to: Mail

Mail Stop ISSUE FEE
Commissioner for Patents
P.O. Box 1450
Alexandria, Virginia 22313-1450

or Fax (571)-273-2885

INSTRUCTIONS: This form should be used for transmitting the ISSUE FEE and PUBLICATION FEE (if required). Blocks 1 through 5 should be completed where appropriate. All further correspondence including the Patent, advance orders and notification of maintenance fees will be mailed to the current correspondence address as indicated unless corrected below or directed otherwise in Block 1, by (a) specifying a new correspondence address; and/or (b) indicating a separate "FEE ADDRESS" for maintenance fee notifications.

CURRENT CORRESPONDENCE ADDRESS (Note: Use Block 1 for any change of address)

26646 7590 03/04/2016
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

Note: A certificate of mailing can only be used for domestic mailings of the Fee(s) Transmittal. This certificate cannot be used for any other accompanying papers. Each additional paper, such as an assignment or formal drawing, must have its own certificate of mailing or transmission.

Certificate of Mailing or Transmission

I hereby certify that this Fee(s) Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Mail Stop ISSUE FEE address above, or being facsimile transmitted to the USPTO (571) 273-2885, on the date indicated below.

(Depositor's name)
(Signature)
(Date)

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

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nonprovisional	UNDISCOUNTED	$960	$0	$0	$960	06/06/2016

EXAMINER	ART UNIT	CLASS-SUBCLASS
SALVITTI, MICHAEL A	1767	524-843000

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363).
   - ☐ Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
   - ☐ "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47; Rev 03-02 or more recent) attached. **Use of a Customer Number is required.**

2. For printing on the patent front page, list

(1) The names of up to 3 registered patent attorneys or agents OR, alternatively,

(2) The name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

1 ____________________
2 ____________________
3 ____________________

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)

PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. If an assignee is identified below, the document has been filed for recordation as set forth in 37 CFR 3.11. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY and STATE OR COUNTRY)

Please check the appropriate assignee category or categories (will not be printed on the patent) : ☐ Individual ☐ Corporation or other private group entity ☐ Government

4a. The following fee(s) are submitted:
- ☐ Issue Fee
- ☐ Publication Fee (No small entity discount permitted)
- ☐ Advance Order - # of Copies ____________

4b. Payment of Fee(s): **(Please first reapply any previously paid issue fee shown above)**
- ☐ A check is enclosed.
- ☐ Payment by credit card. Form PTO-2038 is attached.
- ☐ The director is hereby authorized to charge the required fee(s), any deficiency, or credits any overpayment, to Deposit Account Number ________ (enclose an extra copy of this form).

5. **Change in Entity Status** (from status indicated above)
- ☐ Applicant certifying micro entity status. See 37 CFR 1.29
- ☐ Applicant asserting small entity status. See 37 CFR 1.27
- ☐ Applicant changing to regular undiscounted fee status.

NOTE: Absent a valid certification of Micro Entity Status (see forms PTO/SB/15A and 15B), issue fee payment in the micro entity amount will not be accepted at the risk of application abandonment.

NOTE: If the application was previously under micro entity status, checking this box will be taken to be a notification of loss of entitlement to micro entity status.

NOTE: Checking this box will be taken to be a notification of loss of entitlement to small or micro entity status, as applicable.

NOTE: This form must be signed in accordance with 37 CFR 1.31 and 1.33. See 37 CFR 1.4 for signature requirements and certifications.

Authorized Signature ______________________ Date ______________________

Typed or printed name ______________________ Registration No. ______________________

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

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ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
SALVITTI, MICHAEL A	

ART UNIT	PAPER NUMBER
1767	

DATE MAILED: 03/04/2016

Determination of Patent Term Adjustment under 35 U.S.C. 154 (b)

(Applications filed on or after May 29, 2000)

The Office has discontinued providing a Patent Term Adjustment (PTA) calculation with the Notice of Allowance.

Section 1(h)(2) of the AIA Technical Corrections Act amended 35 U.S.C. 154(b)(3)(B)(i) to eliminate the requirement that the Office provide a patent term adjustment determination with the notice of allowance. See Revisions to Patent Term Adjustment, 78 Fed. Reg. 19416, 19417 (Apr. 1, 2013). Therefore, the Office is no longer providing an initial patent term adjustment determination with the notice of allowance. The Office will continue to provide a patent term adjustment determination with the Issue Notification Letter that is mailed to applicant approximately three weeks prior to the issue date of the patent, and will include the patent term adjustment on the patent. Any request for reconsideration of the patent term adjustment determination (or reinstatement of patent term adjustment) should follow the process outlined in 37 CFR 1.705.

Any questions regarding the Patent Term Extension or Adjustment determination should be directed to the Office of Patent Legal Administration at (571)-272-7702. Questions relating to issue and publication fee payments should be directed to the Customer Service Center of the Office of Patent Publication at 1-(888)-786-0101 or (571)-272-4200.

OMB Clearance and PRA Burden Statement for PTOL-85 Part B

The Paperwork Reduction Act (PRA) of 1995 requires Federal agencies to obtain Office of Management and Budget approval before requesting most types of information from the public. When OMB approves an agency request to collect information from the public, OMB (i) provides a valid OMB Control Number and expiration date for the agency to display on the instrument that will be used to collect the information and (ii) requires the agency to inform the public about the OMB Control Number's legal significance in accordance with 5 CFR 1320.5(b).

The information collected by PTOL-85 Part B is required by 37 CFR 1.311. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, Virginia 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, Virginia 22313-1450. Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

Privacy Act Statement

The Privacy Act of 1974 (P.L. 93-579) requires that you be given certain information in connection with your submission of the attached form related to a patent application or patent. Accordingly, pursuant to the requirements of the Act, please be advised that: (1) the general authority for the collection of this information is 35 U.S.C. 2(b)(2); (2) furnishing of the information solicited is voluntary; and (3) the principal purpose for which the information is used by the U.S. Patent and Trademark Office is to process and/or examine your submission related to a patent application or patent. If you do not furnish the requested information, the U.S. Patent and Trademark Office may not be able to process and/or examine your submission, which may result in termination of proceedings or abandonment of the application or expiration of the patent.

The information provided by you in this form will be subject to the following routine uses:

1. The information on this form will be treated confidentially to the extent allowed under the Freedom of Information Act (5 U.S.C. 552) and the Privacy Act (5 U.S.C 552a). Records from this system of records may be disclosed to the Department of Justice to determine whether disclosure of these records is required by the Freedom of Information Act.
2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.
3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.
4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).
5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.
6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).
7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.
8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspection or an issued patent.
9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

Notice of Allowability	**Application No.** 14/131,606	**Applicant(s)** ADRIAN MEREDITH ET AL.	
	Examiner MICHAEL A. SALVITTI	**Art Unit** 1767	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address--

All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance (PTOL-85) or other appropriate communication will be mailed in due course. **THIS NOTICE OF ALLOWABILITY IS NOT A GRANT OF PATENT RIGHTS.** This application is subject to withdrawal from issue at the initiative of the Office or upon petition by the applicant. See 37 CFR 1.313 and MPEP 1308.

1. ☒ This communication is responsive to *the amendments received February 5th, 2016*.
   ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on______.

2. ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.

3. ☒ The allowed claim(s) is/are *16-35*. As a result of the allowed claim(s), you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov .

4. ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

   Certified copies:

   a) ☒ All b) ☐ Some *c) ☐ None of the:

   1. ☐ Certified copies of the priority documents have been received.
   2. ☐ Certified copies of the priority documents have been received in Application No. _____ .
   3. ☒ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

   * Certified copies not received: _____.

Applicant has THREE MONTHS FROM THE "MAILING DATE" of this communication to file a reply complying with the requirements noted below. Failure to timely comply will result in ABANDONMENT of this application.
THIS THREE-MONTH PERIOD IS NOT EXTENDABLE.

5. ☐ CORRECTED DRAWINGS (as "replacement sheets") must be submitted.

   ☐ including changes required by the attached Examiner's Amendment / Comment or in the Office action of Paper No./Mail Date _____.

   Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the drawings in the front (not the back) of each sheet. Replacement sheet(s) should be labeled as such in the header according to 37 CFR 1.121(d).

6. ☐ DEPOSIT OF and/or INFORMATION about the deposit of BIOLOGICAL MATERIAL must be submitted. Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Attachment(s)

1. ☐ Notice of References Cited (PTO-892)
2. ☐ Information Disclosure Statements (PTO/SB/08), Paper No./Mail Date _____
3. ☐ Examiner's Comment Regarding Requirement for Deposit of Biological Material
4. ☐ Interview Summary (PTO-413), Paper No./Mail Date _____ .
5. ☐ Examiner's Amendment/Comment
6. ☒ Examiner's Statement of Reasons for Allowance
7. ☐ Other _____.

/MICHAEL A SALVITTI/
Primary Examiner, Art Unit 1767

The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Response to Amendment

The amendments received February 5th, 2016 have been entered. These amendments overcome the 35 U.S.C. 112 (pre-AIA), second paragraph rejections of claims 16-35 set forth in the November 5th, 2016 Non-Final rejection; the rejections of claims 16-35 for issues of indefiniteness have been withdrawn. There are no outstanding rejections at this time.

Allowable Subject Matter

Claims 16-35 are allowed.

The following is an examiner's statement of reasons for allowance:

Pedersen (WO 2010/018202) is the closest prior art of record. The present invention requires urea to comprise 75-100 wt% of the $-NH_2$ or $-NH$ groups in the resin. *Pedersen* teaches away from 100% urea resins (*Pedersen* ¶ [002]) and does not teach or suggest higher than 50 wt% urea polymers (*Pedersen* ¶ [0021]) in the Abstract of *Pedersen* at least 50-70% by weight of the polymer comprises melamine, and as such it would not be possible for it to contain the 75-100% urea as claimed.

Pedersen (WO 2007/040410) requires a formaldehyde scavenger which includes urea (*Pedersen* claim 1). As to the amount of urea, *Pedersen* teaches that more than 1 wt% of urea and preferably 3-10 wt% is added to the composition (*Pedersen* page 9), whereas the claimed invention requires 0-0.9 wt%. To arrive at the invention as claimed while considering *Pedersen* would require the reduction and/or removal of a component which may render the prior art unsatisfactory for its intended purpose (MPEP § 2141.01 V).

The prior art of record does not teach or suggest an adhesive system comprising the claimed elements a. through c. and 0-0.9 wt% urea as claimed.

Any comments considered necessary by applicant must be submitted no later than the payment of the issue fee and, to avoid processing delays, should preferably accompany the issue fee. Such submissions should be clearly labeled “Comments on Statement of Reasons for Allowance.”

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL A. SALVITTI whose telephone number is (571)270-7341. The examiner can normally be reached on Monday-Thursday 8AM-7PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Mark Eashoo can be reached on (571) 272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHAEL A SALVITTI/
Primary Examiner, Art Unit 1767

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L2	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L3	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L4	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L5	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L6	22	L1 L2 L3 L4 L5	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L7	11292	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L8	11295	L6 L7	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L9	3	("4409293").PN.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L10	737	((C08G8/10 OR C09J161/02 OR C09J161/24 OR C09J161/28).CPC.)	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L11	7140	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L12	8710	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/02/25 14:38
L13	865	L12 AND adhesive.ti,ab.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/02/25 14:38
L14	13	L13 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/02/25 14:38
L15	140	L12 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/02/25 14:38
L16	3	L10 AND L15	US-PGPUB; USPAT; EPO; JPO	OR	ON	2016/02/25 14:38
L17	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L18	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L19	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L20	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38

L21	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L22	22	L17 L18 L19 L20 L21	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L23	15	L22 AND amino	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L24	6	L22 AND amino NEAR2 urea	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L25	37	amino NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L26	58	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L27	58	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L28	7	L27 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L29	199	((C09J161/24,32).CPC.)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L30	2	L27 AND L29	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L31	48	L29 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L32	3	"8444805"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L33	1735	f ADJ "nh.sub.2"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L34	311	L33 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L35	5	L34 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L36	3	"0814778.7"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L37	1716	L33 AND acid	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L38	7	L29 AND L33	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L39	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L40	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38

L41	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L42	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L43	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L44	22	L39 L40 L41 L42 L43	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L45	11292	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L46	11295	L44 L45	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L47	11295	L46	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L48	3	"20100182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L49	2	"2010182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L50	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L51	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L52	10488	pedersen.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L53	0	"18202" AND L52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L54	2	$6"18202" AND L52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L55	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L56	2	"201018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L57	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L58	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L59	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L60	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38

L61	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L62	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L63	13366	urea NEAR2 formaldehyde.ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L64	16382	urea WITH formaldehyde.ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L65	1838	L64 AND (acetate OR vinylacetate OR polyvinylacetate).ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L66	5	"2007040410"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L67	0	L65 AND "adhesive.ti,ab,clm"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L68	468	L65 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L69	23	"4409293"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L70	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L71	5	"2007040410"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L72	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L73	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L74	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
L75	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/25 14:38
S1	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:07
S2	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S3	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S4	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S5	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S6	22	S1 S2 S3 S4 S5	US-PGPUB; USPAT;	OR	ON	2014/10/14

			EPO; JPO; DERWENT			11:09
S7	11125	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:09
S8	11128	S6 S7	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S9	3	("4409293").PN.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S10	704	((C08G8/10 OR C09J161/02 OR C09J161/24 OR C09J161/28).CPC.)	US-PGPUB; USPAT	OR	ON	2014/10/14 11:10
S11	6752	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:11
S12	8322	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S13	842	S12 AND adhesive.ti,ab.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S14	13	S13 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S15	134	S12 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:12
S16	2	S10 AND S15	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:12
S17	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S18	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S19	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S20	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S21	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S22	22	S17 S18 S19 S20 S21	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 09:56
S23	15	S22 AND amino	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S24	6	S22 AND amino NEAR2 urea	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S25	36	amino NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S26	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S27	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:41
S28	6	S27 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2014/10/21 14:41

			DERWENT			
S29	179	((C09J161/24,32).CPC.)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S30	2	S27 AND S29	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S31	48	S29 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:44
S32	3	"8444805"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:45
S33	1515	f ADJ "nh.sub.2"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S34	283	S33 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S35	5	S34 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S36	3	"0814778.7"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:47
S37	1498	S33 AND acid	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S38	7	S29 AND S33	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S39	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S40	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S41	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S42	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S43	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S44	22	S39 S40 S41 S42 S43	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S45	11127	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S46	11130	S44 S45	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S47	11130	S46	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S48	3	"20100182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:11

S49	2	"2010182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:11
S50	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:12
S51	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:12
S52	9986	pedersen.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S53	0	"18202" AND S52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S54	2	$6"18202" AND S52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S55	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:14
S56	2	"201018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:15
S57	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:15
S58	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 18:18
S59	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:29
S60	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:30
S61	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:30
S62	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:41
S63	13007	urea NEAR2 formaldehyde.ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:26
S64	15964	urea WITH formaldehyde.ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:26
S65	1770	S64 AND (acetate OR vinylacetate OR polyvinylacetate).ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:26
S66	5	"2007040410"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:29
S67	0	S65 AND "adhesive.ti,ab,clm"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:30

S68	451	S65 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:30
S69	23	"4409293"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:49
S70	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:45
S71	5	"2007040410"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:49
S72	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:52
S73	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:52
S74	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/24 15:54
S75	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2016/02/24 15:54

EAST Search History (Interference)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L76	1758	(urea AND $6aldehyde).ti,ab.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L77	381790	polyvinyl ADJ acetate OR $6vinyl ADJ acetate OR PVA OR PCAc OR polyethylene ADJ vinyl ADJ acetate OR $6vinylacetate OR EVA OR ethylene ADJ vinylacetate OR ethylene ADJ vinyl ADJ acetate OR $6ethylenevinyl ADJ acetate	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L78	328	L76 AND L77	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L79	60	L78 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L80	1870	urea WITH $6aldehyde WITH ratio	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L81	145	L78 AND L80	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L82	28	L79 AND L80	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L83	0	"2010018202"	US-PGPUB; USPAT	OR	ON	2016/02/25 14:38
L84	1520	(urea AND formaldehyde).ti,ab.	US-PGPUB;	OR	ON	2016/02/25 14:39

			USPAT			
L85	276	84 AND 77	US-PGPUB; USPAT	OR	ON	2016/02/25 15:07
L86	54	85 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2016/02/25 15:07
L87	1	"14131606"	US-PGPUB; USPAT	OR	ON	2016/02/25 15:09
L88	737	((C08G8/10 OR C09J161/02 OR C09J161/24 OR C09J161/28).CPC.)	US-PGPUB; USPAT	OR	ON	2016/02/25 15:09
S76	1755	(urea AND $6aldehyde).ti,ab.	US-PGPUB; USPAT	OR	ON	2016/02/24 15:43
S77	381497	polyvinyl ADJ acetate OR $6vinyl ADJ acetate OR PVA OR PCAc OR polyethylene ADJ vinyl ADJ acetate OR $6vinylacetate OR EVA OR ethylene ADJ vinylacetate OR ethylene ADJ vinyl ADJ acetate OR $6ethylenevinyl ADJ acetate	US-PGPUB; USPAT	OR	ON	2016/02/24 15:45
S78	327	S76 AND S77	US-PGPUB; USPAT	OR	ON	2016/02/24 15:45
S79	60	S78 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2016/02/24 15:45
S80	1867	urea WITH $6aldehyde WITH ratio	US-PGPUB; USPAT	OR	ON	2016/02/24 15:45
S81	144	S78 AND S80	US-PGPUB; USPAT	OR	ON	2016/02/24 15:46
S82	28	S79 AND S80	US-PGPUB; USPAT	OR	ON	2016/02/24 15:46
S83	0	"2010018202"	US-PGPUB; USPAT	OR	ON	2016/02/24 15:54

2/25/2016 3:26:04 PM
C:\Users\msalvitti\Documents\EAST\Workspaces\14131606ALL.wsp

Issue Classification	**Application/Control No.** 14131606	**Applicant(s)/Patent Under Reexamination** ADRIAN MEREDITH ET AL.
	Examiner MICHAEL A SALVITTI	**Art Unit** 1767

CPC

Symbol					Type	Version
C09J		161	/	24	F	2013-01-01
C09J		161	/	32	I	2013-01-01
C08G		8	/	10	I	2013-01-01
C09J		161	/	02	I	2013-01-01
C09J		161	/	28	I	2013-01-01
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CPC Combination Sets

Symbol					Type	Set	Ranking	Version
			/					
			/					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/MICHAEL A SALVITTI/ Primary Examiner.Art Unit 1767 (Primary Examiner)	02/25/2016 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure none

Issue Classification	**Application/Control No.**	**Applicant(s)/Patent Under Reexamination**
	14131606	ADRIAN MEREDITH ET AL.
	Examiner	**Art Unit**
	MICHAEL A SALVITTI	1767

US ORIGINAL CLASSIFICATION	
CLASS	**SUBCLASS**
156	331.6

CROSS REFERENCE(S)

CLASS	**SUBCLASS (ONE SUBCLASS PER BLOCK)**				
524	512				

INTERNATIONAL CLASSIFICATION

CLAIMED					**NON-CLAIMED**				
C	0	9	J	161 / 24 (2006.01.01)					

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20
/MICHAEL A SALVITTI/ Primary Examiner.Art Unit 1767 (Primary Examiner)	02/25/2016 (Date)	O.G. Print Claim(s): 1 / O.G. Print Figure: none

Issue Classification	**Application/Control No.** 14131606	**Applicant(s)/Patent Under Reexamination** ADRIAN MEREDITH ET AL.
	Examiner MICHAEL A SALVITTI	**Art Unit** 1767

☐ **Claims renumbered in the same order as presented by applicant** ☐ **CPA** ☐ **T.D.** ☐ **R.1.47**

Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original	Final	Original
-	1	2	17	18	33										
-	2	3	18	19	34										
-	3	4	19	20	35										
-	4	5	20												
-	5	6	21												
-	6	7	22												
-	7	8	23												
-	8	9	24												
-	9	10	25												
-	10	11	26												
-	11	12	27												
-	12	13	28												
-	13	14	29												
-	14	15	30												
-	15	16	31												
1	16	17	32												

NONE (Assistant Examiner)	(Date)	**Total Claims Allowed:** 20	
/MICHAEL A SALVITTI/ Primary Examiner.Art Unit 1767 (Primary Examiner)	02/25/2016 (Date)	O.G. Print Claim(s) 1	O.G. Print Figure none

Search Notes	**Application/Control No.** 14131606	**Applicant(s)/Patent Under Reexamination** ADRIAN MEREDITH ET AL.
	Examiner MICHAEL A SALVITTI	**Art Unit** 1767

CPC- SEARCHED

Symbol	Date	Examiner
C09J161/32	10/22/2014	M.S.
C09J161/24	10/22/2014	M.S.
C09J161/02	2/25/2016	M.S.
C09J161/28	2/25/2016	M.S.
C08G8/10	2/25/2016	M.S.

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES

Search Notes	Date	Examiner
1) EAST Inventor/Assignee search	10/22/2014	M.S.
2) EAST keyword search	10/22/2014	M.S.
3) Updated EAST keyword search	2/24/2015	M.S.
4) Updated EAST search	11/2/2015	M.S.
5) Updated EAST search	2/25/2016	M.S.

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
C09J161	24	2/25/2016	M.S.
C09J161	32	2/25/2016	M.S.
C09J161	28	2/25/2016	M.S.
C08G8	10	2/25/2016	M.S.

/MICHAEL A SALVITTI/
Primary Examiner.Art Unit 1767

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner
C09J161	02	2/25/2016	M.S.

	/MICHAEL A SALVITTI/ Primary Examiner.Art Unit 1767

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s) : Jenny ADRIAN MEREDITH et al.

Serial No. : 14/131,606

Filed : January 8, 2014

For : ADHESIVE SYSTEM

Examiner : Michael A. SALVITTI

Art Unit : 1767

Confirmation No. : 4983

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office via the Office electronic filing system on

Date: February 5, 2016

Signature: /Neil H. Benowitz/
Neil H. Benowitz

RESPONSE TO OFFICE ACTION

S I R:

In response to the Office Action mailed on November 5, 2015 ("Office Action"), please enter the following Amendment and Remarks.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 6 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-15. (cancelled).

16. (currently amended) An adhesive system comprising

a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, and wherein ~~urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin~~ the urea based amino resin is a condensation product of formaldehyde and at least one compound carrying -NH_2 or -NH groups in which urea constitutes from 75 to 100 wt% of said at least one compound carrying -NH_2 or -NH groups;

b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,

c. an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA);

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

17. (currently amended) The adhesive system according to claim 16, wherein the ~~urea-formaldehyde resin has an~~ F/NH_2 ratio is from 0.4 to 0.6.

18. (currently amended) The adhesive system according to claim 17, wherein the ~~urea-formaldehyde resin has an~~ F/NH_2 ratio is from 0.45 to 0.55.

19. (previously presented) The adhesive system according to claim 16, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

20. (previously presented) The adhesive system according to claim 19, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

21. (previously presented) The adhesive system according to claim 16, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

22. (currently amended) The adhesive system according to claim 16, wherein the hardener component comprises ~~comprise~~ at least one aluminium salt.

23. (previously presented) The adhesive system according to claim 16, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

24. (previously presented) The adhesive system according to claim 16, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

25. (previously presented) A method of producing a wood based product, comprising applying the adhesive system according to claim 16 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

26. (previously presented) The adhesive system according to claim 18, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

27. (previously presented) The adhesive system according to claim 26, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

28. (previously presented) The adhesive system according to claim 18, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

29. (previously presented) The adhesive system according to claim 19, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

30. (currently amended) The adhesive system according to claim 18, wherein the hardener component comprises ~~comprise~~ at least one aluminium salt.

31. (currently amended) The adhesive system according to claim 21, wherein the hardener component comprises ~~comprise~~ at least one aluminium salt.

32. (previously presented) The adhesive system according to claim 19, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

33. (previously presented) The adhesive system according to claim 21, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

34. (previously presented) The adhesive system according to claim 19, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

35. (previously presented) A method of producing a wood based product, comprising applying the adhesive system according to claim 33 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

REMARKS

I. INTRODUCTION

Upon entry of the present amendment, claims 16-35 will be pending in the present application. By the present amendment, claims 16-18, 22 and 30-31 have been amended. No new matter has been added herein by the present amendment, as support thereof can be found in the specification at, *inter alia*, page 2, line 29 to page 3, line 3 (with reference to WO 2013/010932).

In view of the foregoing amendments and the following remarks, Applicants respectfully submit that the claims are now in condition for allowance. Applicants point out that the amendments made herein are made without prejudice to the future prosecution of such cancelled, amended or modified subject matter in a related divisional, continuation or continuation-in-part application.

II. ALLOWABLE SUBJECT MATTER

Applicants thank the Examiner for indicating that claims 16-35 would be allowable if rewritten or amended to overcome the rejections under 35 U.S.C. 112 (pre-AIA), second paragraph, as set forth in the Office Action.

III. REJECTIONS UNDER 35 U.S.C. § 112

Claims 16-35 stand rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant, regards as the invention. Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

The Office Action alleged that the claim recitation “wherein urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin” was indefinite due to lack of proper antecedent basis, and because it wasn’t clear whether NH can be present in the claim, or whether it is calculated in the F/NH_2 ratio.

Applicants have herein amended claim 16 to delete this claim recitation, and to instead recite “wherein the urea based amino resin is a condensation product of formaldehyde and at least one compound carrying $-NH_2$ or -NH groups in which urea constitutes from 75 to 100 wt% of said at least one compound carrying $-NH_2$ or -NH groups.” As such, pending claim 16 includes an antecedent basis for the $-NH_2$ and -NH groups. Furthermore, it is clear from pending claim 16 that, independently from the F/NH_2 ratio, from all the $-NH_2$ and -NH containing compounds which are used to prepare the urea based amino resin, urea constitutes from 75-100 wt.%. Thus, one of ordinary skill in the art would understand that despite the fact that urea has no -NH groups, other compounds may be used in the preparation of the resin which do comprise such -NH groups.

Thus, Applicants respectfully submit that the claim rejections under 35 U.S.C. 112 have been overcome and should therefore be withdrawn.

IV. CONCLUSION

Applicants respectfully submit that the pending claims are in condition for allowance and request that such action be taken. If for any reason the Examiner believes that prosecution of this application would be advanced by contact with the Applicants' attorney, the Examiner is invited to contact the undersigned at the telephone number below.

Respectfully submitted,
KENYON & KENYON LLP

Dated: February 5, 2016

By: /Kevin T. Godlewski/
Kevin T. Godlewski
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Electronic Acknowledgement Receipt

EFS ID:	24840164
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Kevin Todd Godlewski/Neil Benowitz
Filer Authorized By:	Kevin Todd Godlewski
Attorney Docket Number:	13877/48501
Receipt Date:	05-FEB-2016
Filing Date:	08-JAN-2014
Time Stamp:	16:21:15
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		13877-48501-Response.pdf	114290 2d7928ba8e3bdc254d819d4f0f86ae49420d572b	yes	8

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Claims	2	5
	Applicant Arguments/Remarks Made in an Amendment	6	8
Warnings:			
Information:			
	Total Files Size (in bytes):	114290	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/131,606	Filing Date 01/08/2014	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐ APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
			TOTAL	

* If the difference in column 1 is less than zero, enter “0” in column 2.

APPLICATION AS AMENDED – PART II

AMENDMENT	02/05/2016	CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD’L FEE	**0**

AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD’L FEE	

* If the entry in column 1 is less than the entry in column 2, write “0” in column 3.
** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 20, enter “20”.
*** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 3, enter “3”.
The “Highest Number Previously Paid For” (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/TRACEY BELL/

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

26646 7590 11/05/2015
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER
SALVITTI, MICHAEL A

ART UNIT	PAPER NUMBER
1767	

NOTIFICATION DATE	DELIVERY MODE
11/05/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@kenyon.com

Office Action Summary	**Application No.** 14/131,606	**Applicant(s)** ADRIAN MEREDITH ET AL.	
	Examiner MICHAEL A. SALVITTI	**Art Unit** 1767	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09/14/2015*.
  ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2a)☐ This action is **FINAL**.   2b)☒ This action is non-final.
3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *16-35* is/are pending in the application.
  5a) Of the above claim(s) _____ is/are withdrawn from consideration.
6)☐ Claim(s) _____ is/are allowed.
7)☒ Claim(s) *16-35* is/are rejected.
8)☒ Claim(s) *16-35* is/are objected to.
9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.
11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
  Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
  Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
  a)☒ All b)☐ Some** c)☐ None of the:
    1.☐ Certified copies of the priority documents have been received.
    2.☐ Certified copies of the priority documents have been received in Application No. _____.
    3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b)
  Paper No(s)/Mail Date _____.
3) ☐ Interview Summary (PTO-413)
  Paper No(s)/Mail Date. _____ .
4) ☐ Other: _____.

The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on September 14th, 2015 has been entered.

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 16-35 are rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Regarding claim 16: Claim 16 recites (emphasis by Office to identify the indefiniteness) "…wherein urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin".

The claim language as amended contains two issues of indefiniteness.

First, "the" does not have antecedent basis in the claim.

Second, it is not clear whether NH can be present in the claim, or whether it is calculated in the F/NH_2 ratio. Urea does not contain NH.

Allowable Subject Matter

Claims 16-35 would be allowable if rewritten or amended to overcome the rejections 35 U.S.C. 112 (pre-AIA), 2nd paragraph, set forth in this Office action.

The following is a statement of reasons for the indication of allowable subject matter:

The closest art of record is as follows:

Pedersen (WO 2010/018202) is the closest prior art of record. The present invention requires the resin component to contain 75-100 wt% of the resin. *Pedersen* teaches away from 100% urea resins (*Pedersen* ¶ [002]) and does not teach or suggest higher than 50 wt% urea polymers (*Pedersen* ¶ [0021]).

Pedersen (WO 2007/040410) requires more than 0.9 wt% of urea to be present in the polymer (*Pedersen* page 9).

The prior art of record does not teach or suggest the invention as presently claimed.

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL A. SALVITTI whose telephone number is

(571)270-7341. The examiner can normally be reached on Monday-Thursday 8AM-7PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on (571) 272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHAEL A SALVITTI/
Examiner, Art Unit 1767

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
L1	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:45
L2	5	"2007040410"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:49
L3	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:52
L4	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 13:52
S1	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:07
S2	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S3	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S4	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S5	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S6	22	S1 S2 S3 S4 S5	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:09
S7	11125	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:09
S8	11128	S6 S7	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S9	3	("4409293").PN.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S10	704	((C08G8/10 OR C09J161/02 OR C09J161/24 OR C09J161/28).CPC.)	US-PGPUB; USPAT	OR	ON	2014/10/14 11:10
S11	6752	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:11
S12	8322	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S13	842	S12 AND adhesive.ti,ab.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S14	13	S13 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S15	134	S12 AND amine WITH	US-PGPUB; USPAT;	OR	ON	2014/10/14

		formaldehyde WITH ratio	EPO; JPO			11:12
S16	2	S10 AND S15	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:12
S17	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S18	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S19	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S20	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S21	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S22	22	S17 S18 S19 S20 S21	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 09:56
S23	15	S22 AND amino	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S24	6	S22 AND amino NEAR2 urea	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S25	36	amino NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S26	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S27	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:41
S28	6	S27 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:41
S29	179	((C09J161/24,32).CPC.)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S30	2	S27 AND S29	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S31	48	S29 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:44
S32	3	"8444805"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:45
S33	1515	f ADJ "nh.sub.2"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S34	283	S33 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S35	5	S34 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S36	3	"0814778.7"	US-PGPUB; USPAT;	OR	ON	2014/10/21

			EPO; JPO; DERWENT			14:47
S37	1498	S33 AND acid	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S38	7	S29 AND S33	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S39	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S40	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S41	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S42	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S43	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S44	22	S39 S40 S41 S42 S43	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S45	11127	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S46	11130	S44 S45	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S47	11130	S46	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S48	3	"20100182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:11
S49	2	"2010182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:11
S50	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:12
S51	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:12
S52	9986	pedersen.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S53	0	"18202" AND S52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S54	2	$6"18202" AND S52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S55	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:14
S56	2	"201018202"	US-PGPUB; USPAT; EPO; JPO;	OR	ON	2015/02/24 09:15

			DERWENT			
S57	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:15
S58	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 18:18
S59	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:29
S60	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:30
S61	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:30
S62	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/06/08 18:41
S63	13007	urea NEAR2 formaldehyde.ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:26
S64	15964	urea WITH formaldehyde.ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:26
S65	1770	S64 AND (acetate OR vinylacetate OR polyvinylacetate).ti,ab.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:26
S66	5	"2007040410"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:29
S67	0	S65 AND "adhesive.ti,ab,clm"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:30
S68	451	S65 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:30
S69	23	"4409293"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/11/02 10:49

11/2/2015 2:31:48 PM
C:\Users\msalvitti\Documents\EAST\Workspaces\14131606FAOM.wsp

Search Notes	**Application/Control No.** 14131606	**Applicant(s)/Patent Under Reexamination** ADRIAN MEREDITH ET AL.
	Examiner MICHAEL A SALVITTI	**Art Unit** 1767

CPC- SEARCHED

Symbol	Date	Examiner
C09J161/32	10/22/2014	M.S.
C09J161/24	10/22/2014	M.S.

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES

Search Notes	Date	Examiner
1) EAST Inventor/Assignee search	10/22/2014	M.S.
2) EAST keyword search	10/22/2014	M.S.
3) Updated EAST keyword search	2/24/2015	M.S.
4) Updated EAST search	11/2/2015	M.S.

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 10/13/2015

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Doc code: RCEX
Doc description: Request for Continued Examination (RCE)

PTO/SB/30EFS (07-09)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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REQUEST FOR CONTINUED EXAMINATION(RCE)TRANSMITTAL (Submitted Only via EFS-Web)

Application Number	14131606	Filing Date	2014-01-08	Docket Number (if applicable)	13877/48501	Art Unit	1767
First Named Inventor	Jenny ADRIAN MEREDITH			Examiner Name	Michael A. SALVITTI		

This is a Request for Continued Examination (RCE) under 37 CFR 1.114 of the above-identified application.
Request for Continued Examination (RCE) practice under 37 CFR 1.114 does not apply to any utility or plant application filed prior to June 8, 1995, or to any design application. The Instruction Sheet for this form is located at WWW.USPTO.GOV

SUBMISSION REQUIRED UNDER 37 CFR 1.114

Note: If the RCE is proper, any previously filed unentered amendments and amendments enclosed with the RCE will be entered in the order in which they were filed unless applicant instructs otherwise. If applicant does not wish to have any previously filed unentered amendment(s) entered, applicant must request non-entry of such amendment(s).

☐ Previously submitted. If a final Office action is outstanding, any amendments filed after the final Office action may be considered as a submission even if this box is not checked.

- ☐ Consider the arguments in the Appeal Brief or Reply Brief previously filed on ____________
- ☐ Other ____________

☒ Enclosed

- ☒ Amendment/Reply
- ☐ Information Disclosure Statement (IDS)
- ☐ Affidavit(s)/ Declaration(s)
- ☐ Other ____________

MISCELLANEOUS

☐ Suspension of action on the above-identified application is requested under 37 CFR 1.103(c) for a period of months ____________
(Period of suspension shall not exceed 3 months; Fee under 37 CFR 1.17(i) required)

☐ Other ____________

FEES

☒ **The RCE fee under 37 CFR 1.17(e) is required by 37 CFR 1.114 when the RCE is filed.**
The Director is hereby authorized to charge any underpayment of fees, or credit any overpayments, to Deposit Account No 110600

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

☒ Patent Practitioner Signature
☐ Applicant Signature

PTO/SB/30EFS (07-09)
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Signature of Registered U.S. Patent Practitioner			
Signature	/Kevin T. Godlewski/	Date (YYYY-MM-DD)	2015-09-14
Name	Kevin T. Godlewski	Registration Number	47598

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.11 and 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450.

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

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The information provided by you in this form will be subject to the following routine uses:

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2. A record from this system of records may be disclosed, as a routine use, in the course of presenting evidence to a court, magistrate, or administrative tribunal, including disclosures to opposing counsel in the course of settlement negotiations.

3. A record in this system of records may be disclosed, as a routine use, to a Member of Congress submitting a request involving an individual, to whom the record pertains, when the individual has requested assistance from the Member with respect to the subject matter of the record.

4. A record in this system of records may be disclosed, as a routine use, to a contractor of the Agency having need for the information in order to perform a contract. Recipients of information shall be required to comply with the requirements of the Privacy Act of 1974, as amended, pursuant to 5 U.S.C. 552a(m).

5. A record related to an International Application filed under the Patent Cooperation Treaty in this system of records may be disclosed, as a routine use, to the International Bureau of the World Intellectual Property Organization, pursuant to the Patent Cooperation Treaty.

6. A record in this system of records may be disclosed, as a routine use, to another federal agency for purposes of National Security review (35 U.S.C. 181) and for review pursuant to the Atomic Energy Act (42 U.S.C. 218(c)).

7. A record from this system of records may be disclosed, as a routine use, to the Administrator, General Services, or his/her designee, during an inspection of records conducted by GSA as part of that agency's responsibility to recommend improvements in records management practices and programs, under authority of 44 U.S.C. 2904 and 2906. Such disclosure shall be made in accordance with the GSA regulations governing inspection of records for this purpose, and any other relevant (i.e., GSA or Commerce) directive. Such disclosure shall not be used to make determinations about individuals.

8. A record from this system of records may be disclosed, as a routine use, to the public after either publication of the application pursuant to 35 U.S.C. 122(b) or issuance of a patent pursuant to 35 U.S.C. 151. Further, a record may be disclosed, subject to the limitations of 37 CFR 1.14, as a routine use, to the public if the record was filed in an application which became abandoned or in which the proceedings were terminated and which application is referenced by either a published application, an application open to public inspections or an issued patent.

9. A record from this system of records may be disclosed, as a routine use, to a Federal, State, or local law enforcement agency, if the USPTO becomes aware of a violation or potential violation of law or regulation.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Jenny ADRIAN MEREDITH et al.
Serial No.	:	14/131,606
Filed	:	January 8, 2014
For	:	ADHESIVE SYSTEM
Examiner	:	Michael A. SALVITTI
Art Unit	:	1767
Confirmation No.	:	4983

Mail Stop RCE
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office via the Office electronic filing system on

Date: September 14, 2015

Signature: /Neil H. Benowitz/
Neil H. Benowitz

RCE AMENDMENT

S I R:

In response to the final Office Action mailed on March 13, 2015 ("Office Action"), please enter the following Amendment and Remarks.

Amendments to the Claims are reflected in the listing of claims which begins on page 2 of this paper.

Remarks begin on page 6 of this paper.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-15. (cancelled).

16. (currently amended) An adhesive system comprising
    a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, and wherein urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin;
    b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
    c. an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) ~~and~~ or poly ethylene vinylacetate (EVA);

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

17. (previously presented) The adhesive system according to claim 16, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

18. (previously presented) The adhesive system according to claim 17, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

19. (previously presented) The adhesive system according to claim 16, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

20. (previously presented) The adhesive system according to claim 19, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

21. (previously presented) The adhesive system according to claim 16, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

22. (previously presented) The adhesive system according to claim 16, wherein the hardener component comprise at least one aluminium salt.

23. (previously presented) The adhesive system according to claim 16, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

24. (previously presented) The adhesive system according to claim 16, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

25. (previously presented) A method of producing a wood based product, comprising applying the adhesive system according to claim 16 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

26. (previously presented) The adhesive system according to claim 18, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

27. (previously presented) The adhesive system according to claim 26, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

28. (previously presented) The adhesive system according to claim 18, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

29. (previously presented) The adhesive system according to claim 19, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

30. (previously presented) The adhesive system according to claim 18, wherein the hardener component comprise at least one aluminium salt.

31. (previously presented) The adhesive system according to claim 21, wherein the hardener component comprise at least one aluminium salt.

32. (previously presented) The adhesive system according to claim 19, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

33. (previously presented) The adhesive system according to claim 21, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

34. (previously presented) The adhesive system according to claim 19, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

35. (previously presented) A method of producing a wood based product, comprising applying the adhesive system according to claim 33 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

REMARKS

I. INTRODUCTION

Upon entry of the present amendment, claims 16-35 will be pending in the present application. By the present amendment, claim 16 has been amended. No new matter has been added herein by the present amendment, as support thereof can be found in the specification at, *inter alia*, page 3, lines 1-3 (with reference to WO 2013/010932).

In view of the foregoing amendments and the following remarks, Applicants respectfully submit that the claims are now in condition for allowance. Applicants point out that the amendments made herein are made without prejudice to the future prosecution of such cancelled, amended or modified subject matter in a related divisional, continuation or continuation-in-part application.

II. REJECTIONS UNDER 35 U.S.C. § 102

Claims 16-20, 22-27, 30, 32 and 34 stand rejected under pre-AIA 35 U.S.C. §102(b) as being anticipated by Pedersen et al. (WO 2010/018202). Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

Independent claim 16 has been amended to recite an adhesive system comprising: (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, and wherein urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin.

Pedersen et al. fails to teach or suggest an adhesive wherein urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin. Although the Office Action cites to paragraph [0021] of Pedersen et al. as allegedly describing the resin component a. of the present invention, this paragraph [0021] of Pedersen et al. describes urea modified melamine formaldehyde resins comprising between 0.1 and 50 wt% urea relative to the total weight of urea and melamine. According to Pedersen et al., preferred resins contain lower amounts of urea. Thus, Pedersen et al. teaches a maximum content of 50 wt% urea relative to the total weight of urea and melamine, with a clear preference for lower urea content. (*See* Pedersen et al., paragraph [0021]). As such, there is no teaching or suggestion in Pedersen et al. of a urea based amino resin wherein urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin. Therefore, claim 16 and all claims depending therefrom are not anticipated by Pedersen et al.

III. REJECTIONS UNDER 35 U.S.C. § 103

Claims 16-20, 22-27, 30, 32 and 34 stand rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over Pedersen et al. in view of Tinkelenberg et al. (EP 0025245). Claims 21, 28-29, 31, 33 and 35 stand rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over either: (1) Pedersen et al. as applied to claims 16, 18 and 19 above; or alternatively, (2) Pedersen et al. in view of Tinkelenberg et al. as applied to claims 16, 18 and 19, and further in view of Pinciroli (EP 0501174). Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

As described above, Pedersen et al. fails to teach or suggest an adhesive wherein urea constitutes from 75 to 100 wt% of the NH_2 or NH compounds in the resin. Because Pedersen et al. teaches a strong preference for a lower urea content (*see* Pedersen et al., paragraph [0021]), there would also be no reason or motivation for one of ordinary skill in the art to modify Pedersen et al. in order to arrive at the presently claimed adhesive system.

Tinkelenberg et al. and Pinciroli do not cure the deficiencies of Pedersen et al.

Tinkelenberg et al. teaches to reach the F/NH_2 ratio by adding additional urea after preparation of the amino resin, or even to the wood chips (*see* Tinkelenberg et al., page 3, lines 19-29). However, in accordance with the present invention, no or only a very small amount of urea is added separately to the adhesive system. This is in direct contrast to the teaching of Tinkelenberg et al., which describes adding urea as a separate component. Therefore, one of ordinary skill in the art following the teaching of Tinkelenberg et al. would not have arrived at the presently claimed adhesive system.

For at least the preceding reasons, Pedersen et al., Tinkelenberg et al. and Pinciroli, alone or in combination, do not render the presently recited adhesive system obvious. Thus, it is respectfully submitted that the rejections of the claims as obvious under 35 U.S.C. §103(a) have been overcome and should therefore be withdrawn.

IV. CONCLUSION

Applicants respectfully submit that the pending claims are in condition for allowance and request that such action be taken. If for any reason the Examiner believes that prosecution of this application would be advanced by contact with the Applicants' attorney, the Examiner is invited to contact the undersigned at the telephone number below.

Respectfully submitted,
KENYON & KENYON LLP

Dated: September 14, 2015

By: /Kevin T. Godlewski/
Kevin T. Godlewski
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Electronic Patent Application Fee Transmittal

Application Number:	14131606
Filing Date:	08-Jan-2014
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Filer:	Kevin Todd Godlewski/Neil Benowitz
Attorney Docket Number:	13877/48501

Filed as Large Entity

Filing Fees for **U.S. National Stage under 35 USC 371**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Post-Allowance-and-Post-Issuance:				
Extension-of-Time:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension - 3 months with $200 paid	1253	1	1200	1200
Miscellaneous:				
Request for Continued Examination	1801	1	1200	1200
	Total in USD ($)			**2400**

Electronic Acknowledgement Receipt

EFS ID:	23478552
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Kevin Todd Godlewski/Neil Benowitz
Filer Authorized By:	Kevin Todd Godlewski
Attorney Docket Number:	13877/48501
Receipt Date:	14-SEP-2015
Filing Date:	08-JAN-2014
Time Stamp:	11:48:01
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$2400
RAM confirmation Number	10002
Deposit Account	110600
Authorized User	KENYON & KENYON LLP

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File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Request for Continued Examination (RCE)	13877-48501-RCE.pdf	697853 8d0d508a9ae85a506a002401727ee6709b32484c	no	3
Warnings:					
Information:					
2		13877-48501-Amendment.pdf	115035 fd3998b4b423f89091c8c6d905e40137e3f58b59	yes	9

Multipart Description/PDF files in .zip description

Document Description	Start	End
Amendment Submitted/Entered with Filing of CPA/RCE	1	1
Claims	2	5
Applicant Arguments/Remarks Made in an Amendment	6	9

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
Warnings:					
Information:					
3	Fee Worksheet (SB06)	fee-info.pdf	32636 cf026271a339788d9227eb8058748140923fcd4d	no	2
Warnings:					
Information:					

Total Files Size (in bytes):	845524

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If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

PTO/SB/06 (09-11)
Approved for use through 1/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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PATENT APPLICATION FEE DETERMINATION RECORD Substitute for Form PTO-875	Application or Docket Number 14/131,606	Filing Date 01/08/2014	☐ To be Mailed

ENTITY: ☒ LARGE ☐ SMALL ☐ MICRO

APPLICATION AS FILED – PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	RATE ($)	FEE ($)
☐ BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A	
☐ SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A	
☐ EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A	
TOTAL CLAIMS (37 CFR 1.16(i))	minus 20 =	*	X $ =	
INDEPENDENT CLAIMS (37 CFR 1.16(h))	minus 3 =	*	X $ =	
☐APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).			
☐ MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))				
* If the difference in column 1 is less than zero, enter “0” in column 2.			TOTAL	

APPLICATION AS AMENDED – PART II

		(Column 1)		(Column 2)	(Column 3)		
AMENDMENT	09/14/2015	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	* 20	Minus	** 20	= 0	x $80 =	0
	Independent (37 CFR 1.16(h))	* 1	Minus	***3	= 0	x $420 =	0
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD’L FEE	**0**

		(Column 1)		(Column 2)	(Column 3)		
AMENDMENT		CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	RATE ($)	ADDITIONAL FEE ($)
	Total (37 CFR 1.16(i))	*	Minus	**	=	X $ =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	X $ =	
	☐ Application Size Fee (37 CFR 1.16(s))						
	☐ FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))						
						TOTAL ADD’L FEE	

* If the entry in column 1 is less than the entry in column 2, write “0” in column 3.

** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 20, enter “20”.

*** If the “Highest Number Previously Paid For” IN THIS SPACE is less than 3, enter “3”.

The “Highest Number Previously Paid For” (Total or Independent) is the highest number found in the appropriate box in column 1.

LIE
/NICOLE C. LAWRENCE/

This collection of information is required by 37 CFR 1.16. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. **SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.**

If you need assistance in completing the form, call 1-800-PTO-9199 and select option 2.

Document code: WFEE

United States Patent and Trademark Office
Sales Receipt for Accounting Date: 10/13/2015

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FFARMER     ADJ  #00000001      Mailroom Dt:  09/14/2015
             Seq No:          10002    Sales Acctg Dt:  09/14/2015    14131606
                  01    FC : 1253                    -1200.00  OP
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Attorney Docket No. 13877/48501

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Jenny ADRIAN MEREDITH et al.
Serial No.	:	14/131,606
Filed	:	January 8, 2014
For	:	ADHESIVE SYSTEM
Examiner	:	Michael A. SALVITTI
Art Unit	:	1767
Confirmation No.	:	4983

Mail Stop AF
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office via the Office electronic filing system on July 13, 2015

Signature: /Neil H. Benowitz/
Neil H. Benowitz

PETITION FOR EXTENSION OF TIME AND NOTICE OF APPEAL

S I R:

Applicants hereby appeal to the Patent Trial and Appeal Board from the decision of the Examiner made in the Final Office Action dated March 13, 2015.

Please charge the 37 C.F.R. 1.191 Notice of Appeal fee of **$800.00.** The Notice of Appeal fee is being paid by **credit card**.

Applicants also respectfully petition for a one-month extension of time in which to respond to the Final Office Action mailed on March 13, 2015, for which a response period expiring on June 13, 2015, was set. The extended period expires on July 13, 2015. The one-month extension fee of **$200.00** is being paid by **credit card**.

The Commissioner is authorized, as appropriate and/or necessary, to charge any additional fees and/or credit any excess fees to deposit account number 11–0600 of Kenyon & Kenyon LLP, associated with this communication.

Respectfully submitted,

Dated: July 13, 2015

By: /Kevin T. Godlewski/
Kevin T. Godlewski (Reg. No. 47,598)

Kenyon & Kenyon LLP
One Broadway
New York, NY 10004
(212) 425-7200

Electronic Patent Application Fee Transmittal

Application Number:	14131606
Filing Date:	08-Jan-2014
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Filer:	Kevin Todd Godlewski/Neil Benowitz
Attorney Docket Number:	13877/48501

Filed as Large Entity

Filing Fees for **U.S. National Stage under 35 USC 371**

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
Pages:				
Claims:				
Miscellaneous-Filing:				
Petition:				
Patent-Appeals-and-Interference:				
Notice of Appeal	1401	1	800	800
Post-Allowance-and-Post-Issuance:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Extension-of-Time:				
Extension - 1 month with $0 paid	1251	1	200	200
Miscellaneous:				
		Total in USD ($)		**1000**

Electronic Acknowledgement Receipt

EFS ID:	22902541
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Kevin Todd Godlewski/Neil Benowitz
Filer Authorized By:	Kevin Todd Godlewski
Attorney Docket Number:	13877/48501
Receipt Date:	13-JUL-2015
Filing Date:	08-JAN-2014
Time Stamp:	17:14:44
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	yes
Payment Type	Credit Card
Payment was successfully received in RAM	$1000
RAM confirmation Number	4609
Deposit Account	110600
Authorized User	KENYON & KENYON LLP

The Director of the USPTO is hereby authorized to charge indicated fees and credit any overpayment as follows:

Charge any Additional Fees required under 37 C.F.R. 1.492 (National application filing, search, and examination fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.17 (Patent application and reexamination processing fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.19 (Document supply fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.20 (Post Issuance fees)

Charge any Additional Fees required under 37 C.F.R. Section 1.21 (Miscellaneous fees and charges)

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Notice of Appeal Filed	13877-48501-NoticeOfAppeal.pdf	85103 fd0cb27da4e7b0820b30ae2e0aeeca31a839d379	no	1

Warnings:

Information:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
2	Fee Worksheet (SB06)	fee-info.pdf	32219 0c5f04ce13a7f4204f319ecc94b5960f165b6125	no	2

Warnings:

Information:

Total Files Size (in bytes): 117322

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

26646 7590 06/22/2015
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
SALVITTI, MICHAEL A	

ART UNIT	PAPER NUMBER
1767	

NOTIFICATION DATE	DELIVERY MODE
06/22/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@kenyon.com

PTOL-90A (Rev. 04/07)

The present application is being examined under the pre-AIA first to invent provisions.

ADVISORY ACTION

Response to Arguments

The following responses are directed to the document entitled "Remarks" (pages 2-7) received May 18th, 2015.

A) Applicant's arguments with respect to the rejection of claims 16-20, 22-27, 30, 32 and 34 under 35 U.S.C. § 102(b) as being anticipated by *Pedersen et al.* (WO 2010/018202) have been fully considered but they are not persuasive.

1) On pages 2-3, applicant contends that *Pedersen* does not teach or suggest the invention as presently claimed, for the reason that the examples in *Pedersen* are arguably drawn to melamine-formaldehyde compositions, and allegedly do not meet the claimed "urea-based amino resin".

In response, while it is noted that several examples in *Pedersen* are directed to melamine-formaldehyde embodiments, the scope of *Pedersen*'s invention is not limited to melamine-formaldehyde resins. In ¶ [0021], *Pedersen* clearly teaches melamine-urea-formaldehydes (MUF), which is a urea-based amino resin and is a species within applicants' claimed genus of urea-based amino resins.

2) On page 3, applicant contends *Pedersen* does not teach or suggest the invention of record, because he does not explicitly require 0-0.9 wt% of urea, based on the weight of the entire adhesive system.

In response, this argument has been considerd but has not been found to be persuasive for three reasons:

a) First, the present claim language recites (emphasis by Office): "…<u>in addition to</u> any urea present in the urea based amino resin.".

While *Pedersen* does teach that urea additives *<u>may</u> be added as a formaldehyde scavenger* (*Pedersen* ¶ [0032]), *Pedersen* does not require urea to be added to any particular embodiment. The selection of any formaldehyde scavenger other than urea is an embodiment wherein no <u>addition</u> of urea is present, other than the urea based amino resin.

b) The MUF resins of *Pedersen* possess <u>as little as 0.1 wt% urea</u> (*Pedersen* ¶ [0021]). There is no possible way that more than 0.9 wt% urea can be present in embodiments of *Pedersen* containing less than 0.9 wt% urea.

c) In response to any potential arguments pertaining to urea resulting from the breakdown of *Pedersen*'s MUF resin, it is submitted that *Pedersen* inherently possesses the claimed urea content property, because he contains all ingredients, within the claimed amounts. The claimed urea content property is <u>only</u> shown to be greater than 0.9% when hardener "1U" (a hardener containing urea) or "4" (a hardener not used by *Pedersen*) is used by applicant; see Table 2-3 in the originally filed specification. It is submitted that *Pedersen* necessarily possesses the claimed 0.9

wt% or less urea, because he contains all of the claimed ingredients within the claimed amounts, and does not use hardeners shown by applicant to result in high urea content. If it is shown that *Pedersen* does possess urea content within the claimed amount, it is submitted that the present claim language is omitting an element essential to obtain this feature (35 U.S.C. 112(a)).

B) Applicant's arguments with respect to the rejection of claims 16-20, 22-27, 30, 32 and 34 under 35 U.S.C. § 103(a) as being unpatentable over *Pedersen* in view of *Tinkelenberg* (EP 0025245); and claims 21-28-29 further in view of *Pinciroli* (EP 0501174) have been fully considered but they are not persuasive.

1) On page 5, applicant contends that *Pedersen* does not teach the invention as presently claimed, because it is argued that *Pedersen* most prefers urea as the formaldehyde scavenger.

In response, urea is not a required formaldehyde scavenger in *Pedersen*. "A reference may be relied upon for all that it would have reasonably suggested to one having ordinary skill the art, including nonpreferred embodiments". *Merck & Co. v. Biocraft Laboratories*, 874 F.2d 804, 10 USPQ2d 1843 (Fed. Cir.), *cert. denied*, 493 U.S. 975 (1989); MPEP § 2123. Furthermore, the claimed invention is met when an art-recognized alternative (MPEP § 2144.06 II) scavenger from within *Pedersen* is used. There are numerous formaldehyde scavengers taught by Pedersen other than urea in ¶ [0032] and the claimed invention is met upon selection of any of the other claimed formaldehyde scavengers, since no (0%) urea will be present.

2) On pages 5-6, applicant contends that a person having ordinary skill in the art considering *Pedersen* would not look to *Tinkelenberg* for an optimal F/NH_2 ratio, for the reason that the process of *Tinkelenberg* is argued to be different than that of *Pedersen*.

In response, *Pedersen* teaches the claimed ratio of F/NH_2. *Tinkelenberg* is referenced to show that a person having ordinary skill in the art is able to adjust the F/NH_2 ratio within a narrow range (a range encompassed by *Pedersen*) to improve strength and avoid formaldehyde emission (*Tinkelenberg* 2:35-38), both of which are desirable in *Pedersen* (¶ [0001] and [0017]). With regards to other components and elements present in *Tinkelenberg* which are argued to not be required by *Pedersen,* the test for obviousness is not whether the features of a secondary reference may be bodily incorporated into the structure of the primary reference; nor is it that the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981). A person having ordinary skill in the art considering *Pedersen* could have adjusted the F/NH_2 ratios precisely in *Pedersen* though routine experimentation to optimize strength and formaldehyde emissions.

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL A. SALVITTI whose telephone number is

(571)270-7341. The examiner can normally be reached on Monday-Thursday 8AM-7PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on (571) 272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. A. S./
Examiner, Art Unit 1767

/MICHAEL PEPITONE/
Primary Examiner, Art Unit 1767

Advisory Action Before the Filing of an Appeal Brief

Application No. *14/131,606*	**Applicant(s)** ADRIAN MEREDITH ET AL.		
Examiner MICHAEL A. SALVITTI	**Art Unit** 1767	**AIA (First Inventor to File) Status** No	

--The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

THE REPLY FILED 18 May 2015 FAILS TO PLACE THIS APPLICATION IN CONDITION FOR ALLOWANCE.

NO NOTICE OF APPEAL FILED

1. ☒ The reply was filed after a final rejection. No Notice of Appeal has been filed. To avoid abandonment of this application, applicant must timely file one of the following replies: (1) an amendment, affidavit, or other evidence, which places the application in condition for allowance; (2) a Notice of Appeal (with appeal fee) in compliance with 37 CFR 41.31; or (3) a Request for Continued Examination (RCE) in compliance with 37 CFR 1.114 if this is a utility or plant application. Note that RCEs are not permitted in design applications. The reply must be filed within one of the following time periods:
   a) ☐ The period for reply expires _____months from the mailing date of the final rejection.
   b) ☒ The period for reply expires on: (1) the mailing date of this Advisory Action; or (2) the date set forth in the final rejection, whichever is later. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of the final rejection.
   c) ☐ A prior Advisory Action was mailed more than 3 months after the mailing date of the final rejection in response to a first after-final reply filed within 2 months of the mailing date of the final rejection. The current period for reply expires months from the mailing date of *the prior Advisory Action* or SIX MONTHS from the mailing date of the final rejection, whichever is earlier.

   Examiner Note: If box 1 is checked, check either box (a), (b) or (c). ONLY CHECK BOX (b) WHEN THIS ADVISORY ACTION IS THE FIRST RESPONSE TO APPLICANT'S FIRST AFTER-FINAL REPLY WHICH WAS FILED WITHIN TWO MONTHS OF THE FINAL REJECTION. ONLY CHECK BOX (c) IN THE LIMITED SITUATION SET FORTH UNDER BOX (c). See MPEP 706.07(f).

Extensions of time may be obtained under 37 CFR 1.136(a). The date on which the petition under 37 CFR 1.136(a) and the appropriate extension fee have been filed is the date for purposes of determining the period of extension and the corresponding amount of the fee. The appropriate extension fee under 37 CFR 1.17(a) is calculated from: (1) the expiration date of the shortened statutory period for reply originally set in the final Office action; or (2) as set forth in (b) or (c) above, if checked. Any reply received by the Office later than three months after the mailing date of the final rejection, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

NOTICE OF APPEAL

2. ☐ The Notice of Appeal was filed on _____. A brief in compliance with 37 CFR 41.37 must be filed within two months of the date of filing the Notice of Appeal (37 CFR 41.37(a)), or any extension thereof (37 CFR 41.37(e)), to avoid dismissal of the appeal. Since a Notice of Appeal has been filed, any reply must be filed within the time period set forth in 37 CFR 41.37(a).

AMENDMENTS

3. ☐ The proposed amendments filed after a final rejection, but prior to the date of filing a brief, will not be entered because
   a) ☐ They raise new issues that would require further consideration and/or search (see NOTE below);
   b) ☐ They raise the issue of new matter (see NOTE below);
   c) ☐ They are not deemed to place the application in better form for appeal by materially reducing or simplifying the issues for appeal; and/or
   d) ☐ They present additional claims without canceling a corresponding number of finally rejected claims.

   NOTE: _____. (See 37 CFR 1.116 and 41.33(a)).
4. ☐ The amendments are not in compliance with 37 CFR 1.121. See attached Notice of Non-Compliant Amendment (PTOL-324).
5. ☐ Applicant's reply has overcome the following rejection(s): _____.
6. ☐ Newly proposed or amended claim(s) _____ would be allowable if submitted in a separate, timely filed amendment canceling the non-allowable claim(s).
7. ☒ For purposes of appeal, the proposed amendment(s): (a) ☐ will not be entered, or (b) ☒ will be entered, and an explanation of how the new or amended claims would be rejected is provided below or appended.

AFFIDAVIT OR OTHER EVIDENCE

8. ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
9. ☐ The affidavit or other evidence filed after final action, but before or on the date of filing a Notice of Appeal will not be entered because applicant failed to provide a showing of good and sufficient reasons why the affidavit or other evidence is necessary and was not earlier presented. See 37 CFR 1.116(e).
10. ☐ The affidavit or other evidence filed after the date of filing the Notice of Appeal, but prior to the date of filing a brief, will not be entered because the affidavit or other evidence failed to overcome all rejections under appeal and/or appellant fails to provide a showing of good and sufficient reasons why it is necessary and was not earlier presented. See 37 CFR 41.33(d)(1).
11. ☐ The affidavit or other evidence is entered. An explanation of the status of the claims after entry is below or attached.

REQUEST FOR RECONSIDERATION/OTHER

12. ☒ The request for reconsideration has been considered but does NOT place the application in condition for allowance because: see attached.
13. ☐ Note the attached Information *Disclosure Statement*(s). (PTO/SB/08) Paper No(s). _____
14. ☐ Other: _____.

STATUS OF CLAIMS

15. The status of the claim(s) is (or will be) as follows:

   Claim(s) allowed: .
   Claim(s) objected to: .
   Claim(s) rejected: 16-35.
   Claim(s) withdrawn from consideration: .

/MICHAEL PEPITONE/
Primary Examiner, Art Unit 1767

OK TO ENTER: /M.S./

06/08/2015

[13877/48501]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s) : Jenny ADRIAN MEREDITH et al.

Serial No. : 14/131,606

Filed : January 8, 2014

For : ADHESIVE SYSTEM

Examiner : Michael A. SALVITTI

Art Unit : 1767

Confirmation No. : 4983

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

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Date: May 18, 2015

Signature: /Neil H. Benowitz/
Neil H. Benowitz

RESPONSE TO OFFICE ACTION

S I R:

In response to the final Office Action mailed on March 13, 2015 ("Office Action"), please enter the following Remarks.

Remarks begin on page 2 of this paper.

OK TO ENTER: /M.S./

06/08/2015

[13877/48501]

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Jenny ADRIAN MEREDITH et al.
Serial No.	:	14/131,606
Filed	:	January 8, 2014
For	:	ADHESIVE SYSTEM
Examiner	:	Michael A. SALVITTI
Art Unit	:	1767
Confirmation No.	:	4983

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Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office via the Office electronic filing system on

Date: May 18, 2015

Signature: /Neil H. Benowitz/
Neil H. Benowitz

RESPONSE TO OFFICE ACTION

S I R:

In response to the final Office Action mailed on March 13, 2015 ("Office Action"), please enter the following Remarks.

Remarks begin on page 2 of this paper.

REMARKS

I. INTRODUCTION

Upon entry of the present response, claims 16-35 will be pending in the present application. In view of the following remarks, Applicants respectfully request reconsideration of the pending claims.

II. REJECTIONS UNDER 35 U.S.C. § 102

Claims 16-20, 22-27, 30, 32 and 34 stand rejected under pre-AIA 35 U.S.C. §102(b) as being anticipated by Pedersen et al. (WO 2010/018202). Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

Independent claim 16 relates to an adhesive system comprising: (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and (c) an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) and polyethylene vinylacetate (EVA); wherein the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

Although the Office Action states that "the 'urea based amino resin' in limitation a) in claim 1 is not required to possess urea" (Office Action, pages 7-8), Applicants respectfully disagree. Upon reading the pending claims, one of ordinary skill in the art would readily understand that the phrase "a urea based amino resin" means an amino resin that is based on urea. One of ordinary skill in the art would also readily understand that the urea in the amino resin is not present as free, unreacted urea. Instead, it has been reacted with formaldehyde to form a resin, *i.e.*, a polymer.

The claimed adhesive system also comprises "no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin." This means that there is no unreacted urea in the adhesive system, or, if present, the amount thereof is less than 0.9 wt%. That is, the urea present in polymeric form in the "urea based amino resin" is not included in this recited weight percentage calculation, as would be readily understood by one of ordinary skill in the art.

The Office Action again cites to Table 1 on page 17 of Pedersen et al. as allegedly teaching the claimed range of a F/NH_2 ratio for a urea based amino resin. Table 1 of Pedersen et al. summarizes adhesive components, with Entry 1-5 relating to a component which is a melamine formaldehyde resin having a F/NH_2 ratio of 0.53. However, a melamine formaldehyde resin is not an amino resin that is based on urea. As such, as discussed above, a melamine formaldehyde resin is not a urea based amino resin. Therefore, this Entry 1-5 cannot meet the claimed limitation of "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65."

Thus, Pedersen et al. fails to teach or suggest an adhesive system comprising "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65," and comprising "no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin." As such, it is respectfully submitted that the rejections of the claims as anticipated by Pedersen et al. have been overcome and should therefore be withdrawn.

III. REJECTIONS UNDER 35 U.S.C. § 103

Claims 16-20, 22-27, 30, 32 and 34 stand rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over Pedersen et al. in view of Tinkelenberg et al. (EP 0025245). Claims 21, 28-29, 31, 33 and 35 stand rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over either: (1) Pedersen et al. as applied to claims 16, 18 and 19 above; or alternatively, (2) Pedersen et al. in view of Tinkelenberg et al. as applied to claims 16, 18 and 19, and further in view of Pinciroli (EP 0501174). Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

As described above, Pedersen et al. does not teach nor suggest an adhesive system as recited in independent claim 16, which requires "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65," and that "the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin."

Pedersen et al. also provides no reason or motivation for one of ordinary skill in the art to arrive at the presently claimed adhesive system, because Pedersen et al. teaches a strong preference for melamine formaldehyde resins (*see* Pedersen et al., page 7, line 22). Thus, urea-based resins are not preferred by Pedersen et al.

Furthermore, it is most preferred by Pedersen et al. to include urea in the hardener of the adhesive system (*see* Pedersen et al., page 9, lines 27-31). All exemplary hardeners in Pedersen et al. contain urea (*see* Pedersen et al., page 18, Table 2), and the hardener is preferably used in a relatively high amount (*see* Pedersen et al., page 8, lines 28-31). Therefore, Pedersen et al. teaches to use hardeners containing urea, and to mix the hardeners with a resin component to form an adhesive system having an amount far above 0.9 wt.% of urea. Thus, Pedersen et al. teaches away from the presently claimed adhesive system wherein “the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.”

Tinkelenberg et al. and Pinciroli do not cure the deficiencies of Pedersen et al.

Concerning Tinkelenberg et al., Tinkelenberg et al. discloses an aminoplast resin with an F/NH_2 ratio of 0.25 to 0.625 (*see* Tinkelenberg et al., page 2, lines 59-60). Tinkelenberg et al. teaches to achieve the mentioned ratio by adding urea to normally applied urea formaldehyde resins (*see* Tinkelenberg et al., page 3, lines 20-28). Thus, the adhesive systems of Tinkelenberg et al. contain unreacted, free urea in substantial amounts, which is seen in the Examples (*see* Tinkelenberg et al., pages 5-

6). Tinkelenberg et al. teaches adhesive systems containing an amino resin and a substantial amount of unreacted urea. Accordingly, similar to Pedersen et al., Tinkelenberg et al. teaches to include a substantial amount of free urea in the adhesive system. Therefore, Tinkelenberg et al. also teaches away from the presently claimed adhesive system wherein “the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.”

For at least the preceding reasons, Pedersen et al., Tinkelenberg et al. and Pinciroli, alone or in combination, do not render the presently recited adhesive system obvious. Thus, it is respectfully submitted that the rejections of the claims as obvious under 35 U.S.C. §103(a) have been overcome and should therefore be withdrawn.

IV. CONCLUSION

Applicants respectfully submit that the pending claims are in condition for allowance and request that such action be taken. If for any reason the Examiner believes that prosecution of this application would be advanced by contact with the Applicants' attorney, the Examiner is invited to contact the undersigned at the telephone number below.

Respectfully submitted,
KENYON & KENYON LLP

Dated: May 18, 2015

By:/Kevin T. Godlewski/
Kevin T. Godlewski
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Electronic Acknowledgement Receipt

EFS ID:	22379923
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Kevin Todd Godlewski/Neil Benowitz
Filer Authorized By:	Kevin Todd Godlewski
Attorney Docket Number:	13877/48501
Receipt Date:	18-MAY-2015
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Time Stamp:	18:22:51
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		13877-48501-Response.pdf	107397 81fc747a512d4136fa2c5494b4d11c4e69c3f1f5	yes	7

	Multipart Description/PDF files in .zip description		
	Document Description	**Start**	**End**
	Response After Final Action	1	1
	Applicant Arguments/Remarks Made in an Amendment	2	7
Warnings:			
Information:			
Total Files Size (in bytes):		107397	

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

New Applications Under 35 U.S.C. 111

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

26646 7590 03/13/2015
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
SALVITTI, MICHAEL A	

ART UNIT	PAPER NUMBER
1767	

NOTIFICATION DATE	DELIVERY MODE
03/13/2015	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@kenyon.com

Office Action Summary	**Application No.** 14/131,606	**Applicant(s)** ADRIAN MEREDITH ET AL.	
	Examiner MICHAEL A. SALVITTI	**Art Unit** 1767	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01/29/2015*.
  ☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.
3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *16-35* is/are pending in the application.
  5a) Of the above claim(s) _____ is/are withdrawn from consideration.
6)☐ Claim(s) _____ is/are allowed.
7)☒ Claim(s) *16-35* is/are rejected.
8)☐ Claim(s) _____ is/are objected to.
9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.
11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
  Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
  Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
Certified copies:
  a)☒ All b)☐ Some** c)☐ None of the:
    1.☐ Certified copies of the priority documents have been received.
    2.☐ Certified copies of the priority documents have been received in Application No. _____.
    3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date _____.
3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
4) ☐ Other: _____.

The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 16-20, 22-27, 30, 32 and 34 are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by WO 2010/018202 to *Pedersen et al*.

Regarding claims 16-20, 26-27 and 30: *Pedersen* teaches an adhesive system (*Pedersen* Title/Abstract). This system comprises:

a) a resin component comprising a urea-based amino resin (e.g. melamine-urea-formaldehyde (MUF); *Pedersen* ¶ [0021]). This resin contains a F/NH_2 ratio of 0.4-1.2 (*Pedersen* ¶ [0021]) and examples as low as 0.53 (*Pedersen* Table 1 ¶ [0052]), thereby teaching the claimed range with sufficient specificity.

b) a hardener component comprising an acid, acidic salt or acid-generating compound (*Pedersen* ¶ [0033]);

c) at least one polymer comprising polyvinyl acetate (PVAc; *Pedersen* ¶ [0028]); this component is shown to be dispersed in water, and is therefore aqueous (*Pedersen* Table 2 on page 18).

Pedersen does not require urea; no urea in addition to the urea-based amino resin is present when it is not used.

Regarding claim 22: *Pedersen* teaches the hardener component comprising an aluminum salt (*Pedersen* ¶ [0036]).

Regarding claims 23 and 32: *Pedersen* teaches the acidic component is used at 1-20 wt% (¶ [0033]).

Regarding claims 24 and 34: *Pedersen* teaches that component I (containing the urea-based amino resin) is mixed component II at a ratio of about 1:0.5 to 1:1.5. The polymers in these respective components are about half of the respective composition by weight. As such, *Pedersen* teaches about a 2:1 to 10:1 ratio of the urea-based resin to dry polymer.

Regarding claim 25: *Pedersen* teaches a method of producing a wood-based product comprising applying the adhesive system onto a surface of a wooden material and joining the pieces by pressing (e.g. form-pressed wood products, parquet floor elements, and furniture boards; *Pedersen* ¶ [001]; also see e.g. ¶ [0053] which describes the pressing process of joining wood components).

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which

> said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 16-20, 22-27, 30, 32 and 34 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over WO 2010/018202 to *Pedersen et al.* in view of EP 0025245 to *Tinkelberg et al.*

This rejection is an alternative rejection to the rejection made under 35 U.S.C. § 102(b) above to show that the claimed F/NH$_2$ *ratio is an obvious result-effective variable.*

Regarding claims 16-20, 26-27 and 30: *Pedersen* teaches an adhesive system (*Pedersen* Title/Abstract). This system comprises:

a) a resin component comprising a urea-based amino resin (e.g. melamine-urea-formaldehyde (MUF); *Pedersen* ¶ [0021]). This resin contains a F/NH$_2$ ratio of 0.4-1.2 (*Pedersen* ¶ [0021]) and examples as low as 0.53 (*Pedersen* Table 1 ¶ [0052]).

b) a hardener component comprising an acid, acidic salt or acid-generating compound (*Pedersen* ¶ [0033]);

c) at least one polymer comprising polyvinyl acetate (PVAc; *Pedersen* ¶ [0028]); this component is shown to be dispersed in water, and is therefore aqueous (*Pedersen* Table 2 on page 18).

Pedersen does not require urea; no urea in addition to the urea-based amino resin is present when it is not used; alternative scavengers are taught in ¶ [0032].

Tinkelberg (page 2, lines 29-37) teaches that the F/NH$_2$ ratio within the range of 0.4 to 0.6 is a result-effective variable (MPEP § 2144.05). *Pedersen* and *Tinkelberg* are analogous art, in that they are drawn to the same field of endeavor, namely adhesive systems of urea/formaldehyde/hardeners possessing an overlapping F/NH_2 ratio, used as wood adhesives. At the time of the invention, it would have been obvious for a person having ordinary skill in the art to optimize the F/NH_2 ratio within the claimed range within the overlapping range taught by *Pedersen* through routine experimentation. The motivation in doing so is that a person having ordinary skill in the art would expect to balance the strength while avoiding formaldehyde emission (*Tinkelberg* 2:35-38). Both of these properties are recognized to be desirable traits in *Pedersen* (*Pedersen* ¶ [001] and [0017]).

Regarding claim 22: *Pedersen* teaches the hardener component comprising an aluminum salt (*Pedersen* ¶ [0036]).

Regarding claims 23 and 32: *Pedersen* teaches the acidic component is used at 1-20 wt% (¶ [0033]).

Regarding claims 24 and 34: *Pedersen* teaches that component I (containing the urea-based amino resin) is mixed component II at a ratio of about 1:0.5 to 1:1.5. The polymers in these respective components are about half of the respective composition by weight. As such, *Pedersen* teaches about a 2:1 to 10:1 ratio of the urea-based resin to dry polymer.

Regarding claim 25: *Pedersen* teaches a method of producing a wood-based product comprising applying the adhesive system onto a surface of a wooden material and joining the pieces by pressing (e.g. form-pressed wood products, parquet floor elements, and furniture boards; *Pedersen* ¶ [001]; also see e.g. ¶ [0053] which describes the pressing process of joining wood components).

Claims 21, 28-29, 31, 33 and 35 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over either: **(1)** WO 2010/018202 to *Pedersen et al.* as applied to claims 16, 18 and 19 above; or alternatively **(2)** WO 2010/018202 to *Pedersen et al.* in view of EP 0025245 to *Tinkelberg et al.* as applied to claims 16, 18 and 19, and further in view of EP 0501174 to *Pinciroli;*

Regarding claims 21, 28 and 29: *Pedersen* in isolation or in combination with *Tinkelberg* is silent concerning the polymer comprising polyethylene vinyl acetate (EVA). *Pinciroli* teaches that (poly)ethylene vinyl acetate is an art-recognized equivalent to the polyvinyl acetate used by *Pedersen* (*Pinciroli* 2:15). *Pedersen* and *Tinkelberg* are analogous art, in that they are drawn to the same field of endeavor, namely urea-formaldehyde resins used as wood adhesives. At the time of the invention, it would have been obvious for a person having ordinary skill in the art to substitute the polyvinyl acetate used by *Pedersen* for its art-recognized equivalent EVA resin (MPEP § 2144.06 II) with a reasonable expectation of success in making an adhesive possessing adhesiveness, water resistance while maintaining the hardening capacity (*Pinciroli* 2:5-8) or alternatively enabling the composition to be made with readily available or cheaper materials.

Regarding claim 31: *Pedersen* teaches the hardener component comprising an aluminum salt (*Pedersen* ¶ [0036]).

Regarding claim 33: *Pedersen* teaches the acidic component is used at 1-20 wt% (¶ [0033]).

Regarding claim 35: *Pedersen* teaches a method of producing a wood-based product comprising applying the adhesive system onto a surface of a wooden material and joining the pieces by pressing (e.g. form-pressed wood products, parquet floor elements, and furniture boards; *Pedersen* ¶ [001]; also see e.g. ¶ [0053] which describes the pressing process of joining wood components).

Response to Arguments

The following responses are directed to the document entitled "Remarks" received 1/29/2015.

A) Applicants' argument with respect to the 35 U.S.C. 112 (pre-AIA), second paragraph rejection of claim 24 has been found to be persuasive. This rejection has been withdrawn.

B) Applicant's arguments with respect to the rejection of claims 16-20, 22-27, 30, 32 and 34 as being unpatentable under 35 U.S.C. § 102(b) to *Pedersen* (WO 2010/018202) have been fully considered but they are not persuasive.

On pages 3-4, applicant contends that *Pedersen* does not meet the invention as claimed because *Pedersen* allegedly does not teach the claimed F/NH_2 ratio used in a *urea* based amino resin.

This argument has not been found to be persuasive for two reasons: first, the claimed F/NH_2 molar amount used by *Pedersen* teaches the claimed range with sufficient specificity. *Pedersen* (¶ [0021]) clearly teaches using melamine urea formaldehydes from a very short list of potential choices. Second, the "urea based amino resin" in limitation a) in claim 1 is not required to possess urea. Looking at the last three lines of claim 1, it is recited that in addition to any urea present in the amino resin (Examiner's interpretation: urea is not required to be in said resin), the adhesive system comprises no or less than 0.9 wt% of urea. The cited melamine formaldehyde example in *Pedersen* meets the claimed limitation because it contains no urea, and shows a data point within the narrowest claimed range of F/NH_2 ratio. Therefore applicants' argument has not been found to be persuasive.

C) Applicant's arguments with respect to the rejection of claims 16-20, 22-27, 30, 32 and 34 as being unpatentable under 35 U.S.C. § 103(a) to *Pedersen* (WO 2010/018202) in view of *Tinkelberg* (EP 0025245) have been fully considered but they are not persuasive.

1) On pages 5-6, applicant contends that *Pedersen* allegedly does not teach the 0-0.9 wt% urea limitation, for the reason that his most preferred formaldehyde scavenger is urea.

Urea is not *required* by *Pedersen*. The claimed invention is met when an art-recognized alternative (MPEP § 2144.06 II) scavenger from within *Pedersen* is used. There are numerous formaldehyde scavengers taught by *Pedersen* other than urea in ¶ [0032] and the claimed invention is met upon selection of any of the other claimed formaldehyde scavengers, since no (0%) urea will be present.

2) On pages 7-8, applicant contends that *Tinkelenberg* does not solve the alleged deficiencies of *Pedersen* because the F/NH_2 ratio is calculated on a different basis.

In response, the Abstract of *Tinkelberg* plainly states "according to the invention the binding agent used in the production of the board is a combination of a polyisocyanate with an aminoplast resin containing 0.25 to 0.625 moles of formaldehyde per mole equivalent of aminogroups". This seems to be the same ratio (F/NH_2) claimed by applicant in the present claim language. In the absence of clarification how applicant is interpreting this as it applies to the present claim language, the rejection of record has been maintained. The claimed range of 0.45-0.55 is plainly taught by *Tinkelberg* on page 2 lines 35-39 to be a result effective variable wherein the tradeoff of a higher formaldehyde content is higher strength, while sacrificing increased formaldehyde emission.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL A. SALVITTI whose telephone number is (571)270-7341. The examiner can normally be reached on Monday-Thursday 8AM-7PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on (571) 272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. A. S./
Examiner, Art Unit 1767

/MICHAEL PEPITONE/
Primary Examiner, Art Unit 1767

Search Notes	Application/Control No. 14131606	Applicant(s)/Patent Under Reexamination ADRIAN MEREDITH ET AL.
	Examiner MICHAEL A SALVITTI	Art Unit 1767

CPC- SEARCHED

Symbol	Date	Examiner
C09J161/32	10/22/2014	M.S.
C09J161/24	10/22/2014	M.S.

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES

Search Notes	Date	Examiner
1) EAST Inventor/Assignee search	10/22/2014	M.S.
2) EAST keyword search	10/22/2014	M.S.
3) Updated EAST keyword search	2/24/2015	M.S.

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:07
S2	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S3	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S4	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S5	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S6	22	S1 S2 S3 S4 S5	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:09
S7	11125	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:09
S8	11128	S6 S7	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S9	3	("4409293").PN.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S10	704	((C08G8/10 OR C09J161/02 OR C09J161/24 OR C09J161/28).CPC.)	US-PGPUB; USPAT	OR	ON	2014/10/14 11:10
S11	6752	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:11
S12	8322	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S13	842	S12 AND adhesive.ti,ab.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S14	13	S13 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S15	134	S12 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:12
S16	2	S10 AND S15	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:12
S17	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S18	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S19	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S20	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56

S21	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S22	22	S17 S18 S19 S20 S21	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 09:56
S23	15	S22 AND amino	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S24	6	S22 AND amino NEAR2 urea	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S25	36	amino NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S26	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S27	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:41
S28	6	S27 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:41
S29	179	((C09J161/24,32).CPC.)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S30	2	S27 AND S29	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S31	48	S29 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:44
S32	3	"8444805"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:45
S33	1515	f ADJ "nh.sub.2"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S34	283	S33 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S35	5	S34 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S36	3	"0814778.7"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:47
S37	1498	S33 AND acid	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S38	7	S29 AND S33	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S39	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S40	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08

S41	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S42	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S43	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S44	22	S39 S40 S41 S42 S43	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S45	11127	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S46	11130	S44 S45	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S47	11130	S46	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S48	3	"20100182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:11
S49	2	"2010182202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:11
S50	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:12
S51	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:12
S52	9986	pedersen.in.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S53	0	"18202" AND S52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S54	2	$6"18202" AND S52	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:13
S55	4	"2010018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:14
S56	2	"201018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:15
S57	3	"20100018202"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 09:15
S58	1	"14131606"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2015/02/24 18:18

2/24/2015 9:55:20 PM
C:\Users\msalvitti\Documents\EAST\Workspaces\14131606FAOM.wsp

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s)	:	Jenny ADRIAN MEREDITH et al.
Serial No.	:	14/131,606
Filed	:	January 8, 2014
For	:	ADHESIVE SYSTEM
Examiner	:	Michael A. SALVITTI
Art Unit	:	1767
Confirmation No.	:	4983

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office via the Office electronic filing system on

Date: January 29, 2015

Signature: /Neil H. Benowitz/
Neil H. Benowitz

Mail Stop Amendment
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

RESPONSE TO OFFICE ACTION

S I R:

In response to the Office Action mailed on October 29, 2014 ("Office Action"), please enter the following Remarks.

Remarks begin on page 2 of this paper.

REMARKS

I. INTRODUCTION

Upon entry of the present response, claims 16-35 will be pending in the present application. In view of the following remarks, Applicants respectfully request reconsideration of the pending claims.

II. REJECTIONS UNDER 35 U.S.C. § 112

Claim 24 stands rejected under 35 U.S.C. § 112(b) or 35 U.S.C. § 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA, the applicant, regards as the invention. Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

Claim 24 is directed to the weight ratio of urea based amino resin to polymer in the adhesive system. One of ordinary skill in the art would understand that in a system containing water and/or solvents, such a ratio is only meaningful when the ratio is calculated without any solvents or water, *i.e.*, when it is based on the dry content or solids content. Therefore, it is respectfully submitted that the rejection under 35 U.S.C. § 112 (pre-AIA), second paragraph, has been overcome and should therefore be withdrawn.

III. REJECTIONS UNDER 35 U.S.C. § 102

Claims 16-20, 22-27, 30, 32 and 34 stand rejected under pre-AIA 35 U.S.C. §102(b) as being anticipated by Pedersen et al. (WO 2010/018202). Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

Claim 16 relates to an adhesive system comprising: (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and (c) an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) and polyethylene vinylacetate (EVA); wherein the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

Pedersen et al. describes MF type resins in paragraph [0021] therein. Examples of MF type resins disclosed in Pedersen et al. are melamine formaldehyde (MF), melamine urea formaldehyde (MUF) and other condensates. (Pedersen et al., paragraph [0021]). Most preferably, the resin is MF or etherified MF resin, and the MF type resin has a F/NH_2 molar ratio of 0.4 to 1.2, preferably 0.9 to 1.15. (Pedersen et al., paragraph [0021]). However, there is no unambiguous disclosure of a F/NH_2 ratio being from 0.3 to 0.65 for a <u>urea</u> based amino resin in paragraph [0021] of Pedersen et al.

The Office Action also cites to Table 1 on page 17 of Pedersen et al. as allegedly teaching the claimed range of a F/NH_2 ratio for a urea based amino resin. Table 1 of Pedersen et al. summarizes adhesive components, with Entry 1-5 relating to a component which is a melamine formaldehyde resin having a F/NH_2 ratio of 0.53. However, a melamine formaldehyde resin is not a urea based amino resin. Therefore, this Entry 1-5 cannot meet the claimed limitation of "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65."

Entry 1-2 of Table 1 in Pedersen et al. relates to a component containing a urea formaldehyde type resin having a F/NH_2 ratio of 0.6. This component is mixed with a second component to form an adhesive system. These second components are summarized in Table 2 on page 18 of Pedersen et al. (*See* Pedersen et al., pages 17-18). Entry 1-2 from Table 1 is only combined with component 2-2 from Table 2, as can be seen in Table 3, bridging pages 19 to 20 in Pedersen et al. Component 2-2 contains 25 weight % of urea (*see* Pedersen et al., Table 2), and the mixing ratio between components 1-2 and 2-2 is 100:35 (*see* Pedersen et al., Table 3). Thus, the adhesive system containing a urea based amino resin having a F/NH_2 ratio of 0.6 contains 6.48 weight % of additional urea ((0.25*35)/135). However, the adhesive system recited in claim 16 requires "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65," and that "the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin." Therefore, this Entry 1-2 cannot meet these claim limitations recited in independent claim 16.

For at least the preceding reasons, it is respectfully submitted that the rejections of the claims as anticipated by Pedersen et al. have been overcome and should therefore be withdrawn.

IV. REJECTIONS UNDER 35 U.S.C. § 103

Claims 16-20, 22-27, 30, 32 and 34 stand rejected under pre-AIA 35 U.S.C. §103(b) as being unpatentable over Pedersen et al. in view of Tinkelenberg et al. (EP 0025245). Claims 21, 28-29, 31, 33 and 35 stand rejected under pre-AIA 35 U.S.C. §103(a) as being unpatentable over either: (1) Pedersen et al. as applied to claims 16, 18 and 19 above; or alternatively (2) Pedersen et al. in view of Tinkelenberg et al. as applied to claims 16, 18 and 19, and further in view of Pinciroli (EP 0501174). Applicants respectfully submit that these rejections should be withdrawn for at least the following reasons.

As described above, Pedersen et al. does not teach nor suggest an adhesive system as recited in independent claim 16, which requires "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65," and that "the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin."

Furthermore, Pedersen et al. describes that the second adhesive component contains a large amount of formaldehyde scavenger (*see* Pedersen et al., page 8, lines 28-29). According to Pedersen et al., the most preferred formaldehyde scavenger is urea (*see* Pedersen et al., page 9, lines 30-31), and it is most preferably present in the second adhesive component in an amount of 25-35 wt % (*see* Pedersen et al., page 10, lines 5-7). Thus, Pedersen et al. teaches to include an additional high amount of urea in the adhesive system.

In accordance with the present invention, the inventors found that the addition of significant amounts of urea reduces the formaldehyde emissions, but it also leads to longer press times being required. It is an object of the present invention to provide an adhesive system with low or no emissions of formaldehyde, but still being efficient as a wood adhesive without requiring extremely long press time or high temperature. (*See* specification, page 1, lines 22-26 (with reference to WO 2013/010932)).

The inventors have found that this objective is achieved with the adhesive system of the present invention, which requires "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65," and that "the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin."

Contrary to the presently claimed adhesive system, Pedersen et al. teaches to include <u>high</u> amounts of urea to reduce formaldehyde emission. Thus, Pedersen et al. teaches away from the adhesive system of the present invention, which requires "a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65," and that "the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin." Furthermore, one of ordinary skill in the art, based on the disclosure of Pedersen et al., and aiming to solve the problem of providing an adhesive system enabling both short press time and low emissions, would not even consider omitting or lowering the amount of urea because this would go against the express teaching of Pedersen et al. Thus, there is no reason or motivation for one of ordinary skill in the art to modify the teachings of Pedersen et al. in order to arrive at the presently claimed adhesive system.

Tinkelenberg et al. and Pinciroli do not cure the deficiencies of Pedersen et al.

Concerning Tinkelenberg et al., Tinkelenberg et al. calculates the F/NH_2 ratio based on the overall content of urea (*i.e.*, all of the urea which is present, including the additional amount, is taken into account for the determination of the ratio). This can be inferred from the examples of Tinkelenberg et al. In Example 1, the urea is simply mixed with the resin solution (*see* Tinkelenberg et al., page 4, lines 1-15). Therefore, the adhesives of Tinkelenberg et al. contain a large proportion of additional urea, and the F/NH_2 ratio is based on the overall content of urea, including the additional urea which is added subsequently. In contrast to Tinkelenberg et al., the adhesive system of the present invention requires "a urea based amino <u>resin</u> having an F/NH_2 ratio from 0.3 to 0.65," and that "the adhesive system comprises no or less than 0.9 wt % of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin."

For at least the preceding reasons, Pedersen et al., Tinkelenberg et al. and Pinciroli, alone or in combination, do not render the presently recited adhesive system obvious. Thus, it is respectfully submitted that the rejections of the claims as obvious under 35 U.S.C. §103(a) have been overcome and should therefore be withdrawn.

V. CONCLUSION

Applicants respectfully submit that the pending claims are in condition for allowance and request that such action be taken. If for any reason the Examiner believes that prosecution of this application would be advanced by contact with the Applicants' attorney, the Examiner is invited to contact the undersigned at the telephone number below.

Respectfully submitted,
KENYON & KENYON LLP

Dated: January 29, 2015

By:/Kevin T. Godlewski/
Kevin T. Godlewski
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Electronic Acknowledgement Receipt

EFS ID:	21350259
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Kevin Todd Godlewski/Neil Benowitz
Filer Authorized By:	Kevin Todd Godlewski
Attorney Docket Number:	13877/48501
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Application Type:	U.S. National Stage under 35 USC 371

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Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		13877-48501-Response.pdf	111338 1d4ac95f3e28352c1b8d116961b655d4ca0724af	yes	8

	Multipart Description/PDF files in .zip description		
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	Amendment/Req. Reconsideration-After Non-Final Reject	1	1
	Applicant Arguments/Remarks Made in an Amendment	2	8
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New Applications Under 35 U.S.C. 111
If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

National Stage of an International Application under 35 U.S.C. 371
If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

New International Application Filed with the USPTO as a Receiving Office
If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

26646 7590 10/29/2014
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
SALVITTI, MICHAEL A	
ART UNIT	PAPER NUMBER
1767	

NOTIFICATION DATE	DELIVERY MODE
10/29/2014	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

uspto@kenyon.com

Office Action Summary	**Application No.** 14/131,606	**Applicant(s)** ADRIAN MEREDITH ET AL.	
	Examiner MICHAEL A. SALVITTI	**Art Unit** 1767	**AIA (First Inventor to File) Status** No

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTHS FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *05/26/2014*.
☐ A declaration(s)/affidavit(s) under **37 CFR 1.130(b)** was/were filed on _____.
2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.
3)☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on _____; the restriction requirement and election have been incorporated into this action.
4)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims*

5)☒ Claim(s) *16-35* is/are pending in the application.
5a) Of the above claim(s) _____ is/are withdrawn from consideration.
6)☐ Claim(s) _____ is/are allowed.
7)☒ Claim(s) *16-35* is/are rejected.
8)☐ Claim(s) _____ is/are objected to.
9)☐ Claim(s) _____ are subject to restriction and/or election requirement.

* If any claims have been determined allowable, you may be eligible to benefit from the **Patent Prosecution Highway** program at a participating intellectual property office for the corresponding application. For more information, please see http://www.uspto.gov/patents/init_events/pph/index.jsp or send an inquiry to PPHfeedback@uspto.gov.

Application Papers

10)☐ The specification is objected to by the Examiner.
11)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

Certified copies:

a)☒ All b)☐ Some** c)☐ None of the:
1.☐ Certified copies of the priority documents have been received.
2.☐ Certified copies of the priority documents have been received in Application No. _____.
3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

** See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☒ Information Disclosure Statement(s) (PTO/SB/08a and/or PTO/SB/08b) Paper No(s)/Mail Date *05/26/2014*.
3) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
4) ☐ Other: _____.

The present application is being examined under the pre-AIA first to invent provisions.

DETAILED ACTION

Claim Rejections - 35 USC § 112

The following is a quotation of 35 U.S.C. 112(b):

> (b) CONCLUSION.—The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the inventor or a joint inventor regards as the invention.

The following is a quotation of 35 U.S.C. 112 (pre-AIA), second paragraph:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claim 24 is rejected under 35 U.S.C. 112(b) or 35 U.S.C. 112 (pre-AIA), second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which the inventor or a joint inventor, or for pre-AIA the applicant regards as the invention.

Regarding claim 24: Claim 24 recites “dry polymer”. This limitation is indefinite, because at least polymer component c) is required to be in an aqueous dispersion. For the purposes of further examination, the claimed ratio will be interpreted to be on the basis of weights of the resin and polymer (excluding solvents and other additives; e.g. a solids basis).

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of pre-AIA 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 16-20, 22-27, 30, 32 and 34 are rejected under pre-AIA 35 U.S.C. 102(b) as being anticipated by WO 2010/018202 to *Pedersen et al.*

Regarding claims 16-20, 26-27 and 30: *Pedersen* teaches an adhesive system (*Pedersen* Title/Abstract). This system comprises:

a) a resin component comprising a urea-based amino resin (e.g. melamine-urea-formaldehyde (MUF); *Pedersen* ¶ [0021]). This resin contains a F/NH_2 ratio of 0.4-1.2 (*Pedersen* ¶ [0021]) and examples as low as 0.53 (*Pedersen* Table 1 ¶ [0052]), thereby teaching the claimed range with sufficient specificity.

b) a hardener component comprising an acid, acidic salt or acid-generating compound (*Pedersen* ¶ [0033]);

c) at least one polymer comprising polyvinyl acetate (PVAc; *Pedersen* ¶ [0028]); this component is shown to be dispersed in water, and is therefore aqueous (*Pedersen* Table 2 on page 18).

Pedersen does not require urea; no urea in addition to the urea-based amino resin is present when it is not used.

Regarding claim 22: *Pedersen* teaches the hardener component comprising an aluminum salt (*Pedersen* ¶ [0036]).

Regarding claims 23 and 32: *Pedersen* teaches the acidic component is used at 1-20 wt% (¶ [0033]).

Regarding claims 24 and 34: *Pedersen* teaches that component I (containing the urea-based amino resin) is mixed component II at a ratio of about 1:0.5 to 1:1.5. The polymers in these respective components are about half of the respective composition by weight. As such, *Pedersen* teaches about a 2:1 to 10:1 ratio of the urea-based resin to dry polymer.

Regarding claim 25: *Pedersen* teaches a method of producing a wood-based product comprising applying the adhesive system onto a surface of a wooden material and joining the pieces by pressing (e.g. form-pressed wood products, parquet floor elements, and furniture boards; *Pedersen* ¶ [001]; also see e.g. ¶ [0053] which describes the pressing process of joining wood components).

Claim Rejections - 35 USC § 103

The following is a quotation of pre-AIA 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 16-20, 22-27, 30, 32 and 34 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over WO 2010/018202 to *Pedersen et al.* in view of EP 0025245 to *Tinkelberg et al.*

This rejection is an alternative rejection to the rejection made under 35 U.S.C. § 102(b) above to show that the claimed F/NH$_2$ *ratio is an obvious result-effective variable.*

Regarding claims 16-20, 26-27 and 30: *Pedersen* teaches an adhesive system (*Pedersen* Title/Abstract). This system comprises:

a) a resin component comprising a urea-based amino resin (e.g. melamine-urea-formaldehyde (MUF); *Pedersen* ¶ [0021]). This resin contains a F/NH$_2$ ratio of 0.4-1.2 (*Pedersen* ¶ [0021]) and examples as low as 0.53 (*Pedersen* Table 1 ¶ [0052]).

b) a hardener component comprising an acid, acidic salt or acid-generating compound (*Pedersen* ¶ [0033]);

c) at least one polymer comprising polyvinyl acetate (PVAc; *Pedersen* ¶ [0028]); this component is shown to be dispersed in water, and is therefore aqueous (*Pedersen* Table 2 on page 18).

Pedersen does not require urea; no urea in addition to the urea-based amino resin is present when it is not used.

Tinkelberg (page 2, lines 29-37) teaches that the F/NH$_2$ ratio within the range of 0.4 to 0.6 is a result-effective variable (MPEP § 2144.05). *Pedersen* and *Tinkelberg* are analogous art, in that they are drawn to the same field of endeavor, namely adhesive systems of urea/formaldehyde/hardeners possessing an overlapping F/NH_2 ratio, used as wood adhesives. At the time of the invention, it would have been obvious for a person having ordinary skill in the art to optimize the F/NH_2 ratio within the claimed range within the overlapping range taught by *Pedersen* through routine experimentation. The motivation in doing so is that a person having ordinary skill in the art would expect to balance the strength while avoiding formaldehyde emission (*Tinkelberg* 2:35-38). Both of these properties are recognized to be desirable traits in *Pedersen* (*Pedersen* ¶ [001] and [0017]).

Regarding claim 22: *Pedersen* teaches the hardener component comprising an aluminum salt (*Pedersen* ¶ [0036]).

Regarding claims 23 and 32: *Pedersen* teaches the acidic component is used at 1-20 wt% (¶ [0033]).

Regarding claims 24 and 34: *Pedersen* teaches that component I (containing the urea-based amino resin) is mixed component II at a ratio of about 1:0.5 to 1:1.5. The polymers in these respective components are about half of the respective composition by weight. As such, *Pedersen* teaches about a 2:1 to 10:1 ratio of the urea-based resin to dry polymer.

Regarding claim 25: *Pedersen* teaches a method of producing a wood-based product comprising applying the adhesive system onto a surface of a wooden material and joining the pieces by pressing (e.g. form-pressed wood products, parquet floor elements, and furniture boards; *Pedersen* ¶ [001]; also see e.g. ¶ [0053] which describes the pressing process of joining wood components).

Claims 21, 28-29, 31, 33 and 35 are rejected under pre-AIA 35 U.S.C. 103(a) as being unpatentable over either: **(1)** WO 2010/018202 to *Pedersen et al.* as applied to claims 16, 18 and 19 above; or alternatively **(2)** WO 2010/018202 to *Pedersen et al.* in view of EP 0025245 to *Tinkelberg et al.* as applied to claims 16, 18 and 19, and further in view of EP 0501174 to *Pinciroli;*

Regarding claims 21, 28 and 29: *Pedersen* in isolation or in combination with *Tinkelberg* is silent concerning the polymer comprising polyethylene vinyl acetate (EVA). *Pinciroli* teaches that (poly)ethylene vinylacetate is an art-recognized equivalent to the polyvinyl acetate used by *Pedersen* (*Pinciroli* 2:15). *Pedersen* and *Tinkelberg* are analogous art, in that they are drawn to the same field of endeavor, namely urea-formaldehyde resins used as wood adhesives. At the time of the invention, it would have been obvious for a person having ordinary skill in the art to substitute the polyvinyl acetate used by *Pedersen* for its art-recognized equivalent EVA resin (MPEP § 2144.06 II) with a reasonable expectation of success in making an adhesive possessing adhesiveness, water resistance while maintaining the hardening capacity (*Pinciroli* 2:5-8) or alternatively enabling the composition to be made with readily available or cheaper materials.

Regarding claim 31: *Pedersen* teaches the hardener component comprising an aluminum salt (*Pedersen* ¶ [0036]).

Regarding claim 33: *Pedersen* teaches the acidic component is used at 1-20 wt% (¶ [0033]).

Regarding claim 35: *Pedersen* teaches a method of producing a wood-based product comprising applying the adhesive system onto a surface of a wooden material and joining the pieces by pressing (e.g. form-pressed wood products, parquet floor elements, and furniture boards; *Pedersen* ¶ [001]; also see e.g. ¶ [0053] which describes the pressing process of joining wood components).

Correspondence

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MICHAEL A. SALVITTI whose telephone number is (571)270-7341. The examiner can normally be reached on Monday-Thursday 8AM-7PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Mark Eashoo can be reached on (571) 272-1197. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/MICHAEL A SALVITTI/
Examiner, Art Unit 1767

Notice of References Cited	Application/Control No. 14/131,606	Applicant(s)/Patent Under Reexamination ADRIAN MEREDITH ET AL.	
	Examiner MICHAEL A. SALVITTI	Art Unit 1767	Page 1 of 1

U.S. PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Name	Classification
*	A	US-4,409,293 A	10-1983	Williams, James H.	428/524
*	B	US-2001/0031825 A1	10-2001	Nasli-Bakir et al.	524/503
*	C	US-2003/0079832 A1	05-2003	Pirhonen et al.	156/330
*	D	US-2007/0269633 A1	11-2007	Nusselder et al.	428/105
*	E	US-2009/0326166 A1	12-2009	No et al.	525/509
*	F	US-2011/0198028 A1	08-2011	PEDERSEN et al.	156/310
*	G	US-8,444,805 B2	05-2013	Pedersen et al.	156/331.5
*	H	US-2013/0189438 A1	07-2013	Gupta et al.	427/379
*	I	US-2014/0014267 A1	01-2014	PEDERSEN et al.	156/331.3
*	J	US-2014/0166204 A1	06-2014	Adrian Meredith et al.	156/331.6
	K	US-			
	L	US-			
	M	US-			

FOREIGN PATENT DOCUMENTS

*		Document Number Country Code-Number-Kind Code	Date MM-YYYY	Country	Name	Classification
	N	WO 2010/018202	02-2010	WO	Pedersen et al.	
	O					
	P					
	Q					
	R					
	S					
	T					

NON-PATENT DOCUMENTS

*		Include as applicable: Author, Title Date, Publisher, Edition or Volume, Pertinent Pages)
	U	
	V	
	W	
	X	

*A copy of this reference is not being furnished with this Office action. (See MPEP § 707.05(a).)
Dates in MM-YYYY format are publication dates. Classifications may be US or foreign.

EAST Search History

EAST Search History (Prior Art)

Ref #	Hits	Search Query	DBs	Default Operator	Plurals	Time Stamp
S1	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:07
S2	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S3	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S4	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S5	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:08
S6	22	S1 S2 S3 S4 S5	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:09
S7	11125	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:09
S8	11128	S6 S7	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S9	3	("4409293").PN.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/14 11:10
S10	704	((C08G8/10 OR C09J161/02 OR C09J161/24 OR C09J161/28).CPC.)	US-PGPUB; USPAT	OR	ON	2014/10/14 11:10
S11	6752	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT	OR	ON	2014/10/14 11:11
S12	8322	(urea AND formaldehyde).ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S13	842	S12 AND adhesive.ti,ab.	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S14	13	S13 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:11
S15	134	S12 AND amine WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:12
S16	2	S10 AND S15	US-PGPUB; USPAT; EPO; JPO	OR	ON	2014/10/14 11:12
S17	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S18	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S19	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S20	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56

S21	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 09:56
S22	22	S17 S18 S19 S20 S21	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 09:56
S23	15	S22 AND amino	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S24	6	S22 AND amino NEAR2 urea	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 10:03
S25	36	amino NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S26	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 13:35
S27	57	amin? NEAR2 $4urea WITH formaldehyde WITH ratio	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:41
S28	6	S27 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:41
S29	179	((C09J161/24,32).CPC.)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S30	2	S27 AND S29	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:43
S31	48	S29 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:44
S32	3	"8444805"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:45
S33	1515	f ADJ "nh.sub.2"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S34	283	S33 AND ($4vinyl ADJ acetate)	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S35	5	S34 AND adhesive.ti,ab,clm.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:46
S36	3	"0814778.7"	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:47
S37	1498	S33 AND acid	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S38	7	S29 AND S33	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 14:48
S39	1	((Jenny) near2 ("Adrian Meredith")).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S40	1	((Anna) near2 (Furberb)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08

S41	1	((Eugeniuez) near2 (Abram)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S42	18	((Benyahia) near2 (Nasli-Bakir)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S43	11	((Salme) near2 (Pirhonen)).INV.	US-PGPUB; USPAT	OR	ON	2014/10/21 15:08
S44	22	S39 S40 S41 S42 S43	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S45	11127	akzo.asn.	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S46	11130	S44 S45	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08
S47	11130	S46	US-PGPUB; USPAT; EPO; JPO; DERWENT	OR	ON	2014/10/21 15:08

10/22/2014 6:43:54 PM
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BIB DATA SHEET

CONFIRMATION NO. 4983

SERIAL NUMBER	FILING or 371(c) DATE	CLASS	GROUP ART UNIT	ATTORNEY DOCKET NO.
14/131,606	01/08/2014 RULE	524	1767	13877/48501

APPLICANTS

INVENTORS
Jenny Adrian Meredith, Arsta, SWEDEN;
Anna Kristina Furberb, Stockholm, SWEDEN;
Eugeniuez Abram, Solna, SWEDEN;
Benyahia Nasli-Bakir, Saltsjo-boo, SWEDEN;
Salme Pirhonen, Sollentuna, SWEDEN;

** **CONTINUING DATA** *************************
This application is a 371 of PCT/EP2012/063766 07/13/2012
which claims benefit of 61/508,205 07/15/2011

** **FOREIGN APPLICATIONS** *************************
EUROPEAN PATENT OFFICE (EPO) 11174128.6 07/15/2011

** **IF REQUIRED, FOREIGN FILING LICENSE GRANTED** **
03/05/2014

		STATE OR COUNTRY	SHEETS DRAWINGS	TOTAL CLAIMS	INDEPENDENT CLAIMS
Foreign Priority claimed ☑ Yes ☐ No 35 USC 119(a-d) conditions met ☑ Yes ☐ No Verified and Acknowledged /MICHAEL A SALVITTI/ Examiner's Signature	☐ Met after Allowance M.S. Initials	SWEDEN	0	20	1

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NEW YORK, NY 10004
UNITED STATES

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Receipt date: 05/26/2014
14131606 - GAU: 1767

Doc code: IDS
Doc description: Information Disclosure Statement (IDS) Filed

PTO/SB/08a (01-10)
Approved for use through 07/31/2012. OMB 0651-0031
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14131606
Filing Date	2014-01-08
First Named Inventor	Jenny Adrian MEREDITH
Art Unit	1746
Examiner Name	
Attorney Docket Number	13877/48501

U.S.PATENTS

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Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
/M.S./	1	4409293		1983-10-11	Williams	

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/M.S./	1	WO 2007/040410	WO		2007-04-12	DYNEA OY		☐
/M.S./	2	WO 03/033610	WO		2003-04-24	AKZO NOBEL N.V.		☐
/M.S./	3	WO 01/70898	WO		2001-09-27	AKZO NOBEL N.V.		☐

Receipt date: 05/26/2014	Application Number	14131606 14131606 - GAU: 1767
INFORMATION DISCLOSURE STATEMENT BY APPLICANT (Not for submission under 37 CFR 1.99)	Filing Date	2014-01-08
	First Named Inventor	Jenny Adrian MEREDITH
	Art Unit	1746
	Examiner Name	
	Attorney Docket Number	13877/48501

/M.S./	4	WO 02/068178	WO		2002-09-06	DYNEA WOOD AND SPECIALITY ADHESIVES		☐
/M.S./	5	EP 1136537	EP		2001-09-26	AKZO NOVEL N.V.		☐
/M.S./	6	EP 0062389	EP		1982-10-13	METHANOL CHEMIE NEDERLAND V.o.F		☐
/M.S./	7	EP 0025245	EP		1981-03-18	METHANOL CHEMIE NEDERLAND V.o.F		☐
/M.S./	8	EP 0107260	EP		1984-05-02	METHANOL CHEMIE NEDERLAND V.o.F		☐
/M.S./	9	EP 0501174	EP		1992-09-02	NATIONAL STARCH AND CHEMICAL S.p.A.		☐

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/M.S./	1	International Search Report and Written Opinion for International Application No. PCT/EP2012/063766 mailed on August 9, 2012.	☐
/M.S./	2	International Preliminary Report on Patentability for International Application No. PCT/EP2012/063766 mailed on September 9, 2013.	☐

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Application Number	14131606 14131606 - GAU: 1767
Filing Date	2014-01-08
First Named Inventor	Jenny Adrian MEREDITH
Art Unit	1746
Examiner Name	
Attorney Docket Number	13877/48501

EXAMINER SIGNATURE			
Examiner Signature	/Michael Salvitti/	Date Considered	10/22/2014

*EXAMINER: Initial if reference considered, whether or not citation is in conformance with MPEP 609. Draw line through a citation if not in conformance and not considered. Include copy of this form with next communication to applicant.

[1] See Kind Codes of USPTO Patent Documents at www.USPTO.GOV or MPEP 901.04. [2] Enter office that issued the document, by the two-letter code (WIPO Standard ST.3). [3] For Japanese patent documents, the indication of the year of the reign of the Emperor must precede the serial number of the patent document. [4] Kind of document by the appropriate symbols as indicated on the document under WIPO Standard ST.16 if possible. [5] Applicant is to place a check mark here if English language translation is attached.

Search Notes	**Application/Control No.** 14131606	**Applicant(s)/Patent Under Reexamination** ADRIAN MEREDITH ET AL.
	Examiner MICHAEL A SALVITTI	**Art Unit** 1767

CPC- SEARCHED

Symbol	Date	Examiner
C09J161/32	10/22/2014	M.S.
C09J161/24	10/22/2014	M.S.

CPC COMBINATION SETS - SEARCHED

Symbol	Date	Examiner

US CLASSIFICATION SEARCHED

Class	Subclass	Date	Examiner

SEARCH NOTES

Search Notes	Date	Examiner
1) EAST Inventor/Assignee search	10/22/2014	M.S.
2) EAST keyword search	10/22/2014	M.S.

INTERFERENCE SEARCH

US Class/ CPC Symbol	US Subclass / CPC Group	Date	Examiner

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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501	4983

26646 7590 09/11/2014
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

EXAMINER	
LEE, DANIEL H.	

ART UNIT	PAPER NUMBER
1746	

NOTIFICATION DATE	DELIVERY MODE
09/11/2014	ELECTRONIC

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The time period for reply, if any, is set in the attached communication.

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uspto@kenyon.com

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In re Application of
Jenny Meredith Adrian et al.
Application No.: 14/131,606
Filed: 08 January 2014
Attorney Docket No.: 13877/48501
For: ADHESIVE SYSTEM

: DECISION ON REQUEST TO
: PARTICIPATE IN THE PATENT
: PROSECUTION HIGHWAY
: PROGRAM AND PETITION
: TO MAKE SPECIAL UNDER
: 37 CFR 1.102(a)

This is a decision on the request to participate in the Patent Prosecution Highway (PPH) program and the petition under 37 CFR 1.102(a), filed 26 May 2014, to make the above-identified application special.

The request and petition are **GRANTED**.

DISCUSSION

A grantable request to participate in the PPH pilot program and petition to make special require:

1. The U.S. application for which participation in the Global/IP5 PPH pilot program is requested must have the same earliest date, whether this is the priority date or filing date, as that of a corresponding national or regional application filed with another Global/IP5 PPH participating office or a corresponding PCT international application for which one of the Global/IP5 PPH participating offices was the International Searching Authority (ISA) or the International Preliminary Examining Authority (IPEA).

2. Applicant must:
   a. Ensure all the claims in the U.S. application must sufficiently correspond or be amended to sufficiently correspond to the allowable/patentable claim(s) in the corresponding Office of Earlier Examination (OEE) application and
   b. Submit a claims correspondence table in English;
3. Examination of the U.S. application has not begun;
4. Applicant must submit:
   a. Documentation of prior office action:
      i. a copy of the office action(s) just prior to the "Decision to Grant a Patent" from each of the Global/IP5 PPH participating office application(s) containing the allowable/patentable claim(s) or

        ii. if the allowable/patentable claims(s) are from a "Notification of Reasons for Refusal" then the Notification of Reasons for Refusal or
        iii. if the Global/IP5 PPH participating office application is a first action allowance then no office action from the Global/IP5 PPH participating office is necessary should be indicated on the request/petition form or
        iv. the latest work product in the international phase of the OEE PCT application;
    b. An English language translation of the Global/IP5 PPH participating office action or work product from (4)(a)(i)-(ii) or (iv) above;
5. Applicant must submit:
    a. An IDS listing the documents cited by the Global/IP5 PPH participating office examiner in the Global/IP5 PPH participating office action or work product (unless already submitted in this application)
    b. Copies of the documents except U.S. patents or U.S. patent application publications (unless already submitted in this application);

The request to participate in the PPH pilot program and petition comply with the above requirements. Accordingly, the above-identified application has been accorded "special" status.

Telephone inquiries concerning this decision should be directed to JoAnne Burke at (571) 272-4584

All other inquiries concerning the examination or status of the application is accessible in the PAIR system at http://www.uspto.gov/ebc.index.html.

This application will be forwarded to the examiner for action on the merits commensurate with this decision once this application's formality reviews have been completed.

/JoAnne Burke/
JoAnne Burke
Paralegal Specialist
Office of Petitions

Office of Petitions: Routing Sheet

4700

Application No. 14/131,606

This application is being forwarded to your office for further processing. A decision has been rendered on a petition filed in this application.

☒ **GRANTED**

☐ **DISMISSED**

☐ **DENIED**

Office of Petitions: Decision Count Sheet

Mailing Month

Application No. 14131606

* 1 4 1 3 1 6 0 6 *

For US serial numbers: enter number only, no slashes or commas. Ex: 10123456
For PCT: enter "51+single digit of year of filing+last 5 numbers", Ex. for PCT/US05/12345, enter 51512345

Deciding Official: BURKE, JOANNE

Count (1) - Palm Credit 14/131,606

Decision: GRANT

FINANCE WORK NEEDED
☐ Select Check Box for YES

* G R A N T *

Decision Type: 652 - Petition to make special-PPH

* 6 5 2 *

Notes:

Count (2)

Decision: n/a

FINANCE WORK NEEDED
☐ Select Check Box for YES

Decision Type: NONE

Notes:

Count (3)

Decision: n/a

FINANCE WORK NEEDED
☐ Select Check Box for YES

Decision Type: NONE

Notes:

Initials of Approving Official (if required)

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APPLICATION NUMBER	FILING OR 371(C) DATE	FIRST NAMED APPLICANT	ATTY. DOCKET NO./TITLE
14/131,606	01/08/2014	Jenny Adrian Meredith	13877/48501

CONFIRMATION NO. 4983

PUBLICATION NOTICE

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26646
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

Title:ADHESIVE SYSTEM

Publication No.US-2014-0166204-A1
Publication Date:06/19/2014

NOTICE OF PUBLICATION OF APPLICATION

The above-identified application will be electronically published as a patent application publication pursuant to 37 CFR 1.211, et seq. The patent application publication number and publication date are set forth above.

The publication may be accessed through the USPTO's publically available Searchable Databases via the Internet at www.uspto.gov. The direct link to access the publication is currently http://www.uspto.gov/patft/.

The publication process established by the Office does not provide for mailing a copy of the publication to applicant. A copy of the publication may be obtained from the Office upon payment of the appropriate fee set forth in 37 CFR 1.19(a)(1). Orders for copies of patent application publications are handled by the USPTO's Office of Public Records. The Office of Public Records can be reached by telephone at (703) 308-9726 or (800) 972-6382, by facsimile at (703) 305-8759, by mail addressed to the United States Patent and Trademark Office, Office of Public Records, Alexandria, VA 22313-1450 or via the Internet.

In addition, information on the status of the application, including the mailing date of Office actions and the dates of receipt of correspondence filed in the Office, may also be accessed via the Internet through the Patent Electronic Business Center at www.uspto.gov using the public side of the Patent Application Information and Retrieval (PAIR) system. The direct link to access this status information is currently http://pair.uspto.gov/. Prior to publication, such status information is confidential and may only be obtained by applicant using the private side of PAIR.

Further assistance in electronically accessing the publication, or about PAIR, is available by calling the Patent Electronic Business Center at 1-866-217-9197.

Office of Data Managment, Application Assistance Unit (571) 272-4000, or (571) 272-4200, or 1-888-786-0101

Doc Code: PPH.PET.652
Document Description: Petition to make special under Patent Pros Hwy

PTO/SB/20GLBL (01-14)
Approved for use through 01/31/2015. OMB 0651-0058
U.S. Patent and Trademark Office; U.S DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

REQUEST FOR PARTICIPATION IN THE GLOBAL/IP5 PATENT PROSECUTION HIGHWAY (PPH) PILOT PROGRAM IN THE USPTO

Application No.:	14/131,606	First Named Inventor:	Jenny Adrian MEREDITH
Filing Date:	January 8, 2014	Attorney Docket No.:	13877/48501
Title of the Invention:	Adhesive System		

THIS REQUEST FOR PARTICIPATION IN THE PPH PILOT PROGRAM ALONG WITH THE REQUIRED DOCUMENTS MUST BE SUBMITTED VIA EFS-WEB. INFORMATION REGARDING EFS-WEB IS AVAILABLE AT HTTP://WWW.USPTO.GOV/PATENTS/PROCESS/FILE/EFS/.

APPLICANT HEREBY REQUESTS PARTICIPATION IN THE PATENT PROSECUTION HIGHWAY (PPH) PILOT PROGRAM AND PETITIONS TO MAKE THE ABOVE-IDENTIFIED APPLICATION SPECIAL UNDER THE PPH PILOT PROGRAM.

Office of earlier examination (OEE): European Patent Office

OEE application number: PCT/EP2012/063766

Both the OEE application and the above-identified U.S. application have the following earliest date (filing or priority date): July 15, 2011

Type of OEE work product relied upon: International Preliminary Examination Report (IPER)

Mailing date of OEE work product: September 9, 2013

I. Required Documents:

a. **A copy of the most recent office action prior to the decision to grant a patent or the most recent PCT work product (along with an English translation, if not in the English language):**

☒ is attached.
☐ is already present in the U.S. application.
☐ is not attached because it is available to the USPTO via the Dossier Access System or WIPO's PATENTSCOPE system.
☐ is not attached because the decision to grant a patent was the first office action.

b. **(1) An information disclosure statement listing the documents cited in the OEE work product:**

☒ is attached.
☐ has already been filed in the U.S. application.
☐ is not attached because no references were cited in the document in section a. above.

(2) Copies of all cited documents (except for U.S. patents or U.S. patent application publications)

☒ are attached.
☐ have already been filed in the U.S. application.
☐ are not attached because no references were cited in the document in section a. above.

PTO/SB/20GLBL (01-14)
Approved for use through 01/31/2015. OMB 0651-0058
U.S. Patent and Trademark Office; U.S DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

REQUEST FOR PARTICIPATION IN THE GLOBAL/IP5 PPH PILOT PROGRAM IN THE USPTO
(continued)

Application No.:	14/131,606	First Named Inventor:	Jenny Adrian MEREDITH

II. Claims Correspondence Table:

Claims in US Application	Patentable Claims in OEE Application	Explanation regarding the correspondence
1-15	--	these claims are cancelled
16	1	claims are substantially the same
17	2	claims are substantially the same
18	3	claims are substantially the same
19	4	claims are substantially the same, except US claim is not multiply dependent
20	5	claims are substantially the same
21	6	claims are substantially the same, except US claim is not multiply dependent
22	7	claims are substantially the same, except US claim is not multiply dependent
23	8	claims are substantially the same, except US claim is not multiply dependent
24	9	claims are substantially the same, except US claim is not multiply dependent
25	10	claims are substantially the same, except US claim is not multiply dependent
26	4	claims are substantially the same, except US claim is not multiply dependent
27	5	claims are substantially the same, except US claim is not multiply dependent
28	6	claims are substantially the same, except US claim is not multiply dependent
29	6	claims are substantially the same, except US claim is not multiply dependent
30	7	claims are substantially the same, except US claim is not multiply dependent
31	7	claims are substantially the same, except US claim is not multiply dependent
32	8	claims are substantially the same, except US claim is not multiply dependent
33	8	claims are substantially the same, except US claim is not multiply dependent
34	9	claims are substantially the same, except US claim is not multiply dependent
35	10	claims are substantially the same, except US claim is not multiply dependent

III. All the claims in the US application sufficiently correspond to the patentable/allowable claims in the OEE application.

Signature /Kevin T. Godlewski/	Date May 26, 2014
Name (Print/Typed) Kevin T. Godlewski	Registration Number 47,598

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SWE11195WOP1	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13.07.2012	Priority date *(day/month/year)* 15.07.2011

International Patent Classification (IPC) or national classification and IPC
INV. C08G8/10

Applicant
Akzo Nobel Coatings International B.V.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   - a. ☒ *sent to the applicant and to the International Bureau)* a total of 5 sheets, as follows:
     - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
     - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   - b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3*bis* of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I	Basis of the report
☐ Box No. II	Priority
☐ Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐ Box No. IV	Lack of unity of invention
☒ Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐ Box No. VI	Certain documents cited
☐ Box No. VII	Certain defects in the international application
☐ Box No. VIII	Certain observations on the international application

Date of submission of the demand 19.04.2013	Date of completion of this report 09.09.2013
Name and mailing address of the international preliminary examining authority: European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016	Authorized officer Kiebooms, Rafaël Telephone No. +31 70 340-2425

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2012/063766

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

☒ the international application in the language in which it was filed

☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
  - ☐ international search (under Rules 12.3(a) and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4(a))
  - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-11	as originally filed	

Claims, Numbers

1-12	filed with the letter of	18-04-2013

☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
  - ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:
  - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
  - ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:

5. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 70.2 (e)).

6. ☐ Supplementary international search report(s) from Authority(ies) have been received and taken into account in drawing up this report (Rule 45bis.8(b) and (c)).

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 WO 2007/040410 A1 (DYNEA OY [FI]; PEDERSEN ASTRID [NO]; SANDBAKKEN PER OLAV [NO]) 12 April 2007 (2007-04-12)

D2 WO 03/033610 A1 (AKZO NOBEL NV [NL]; CASCO PRODUCTS AB [SE]; PIRHONEN SALME [SE]; NASLI) 24 April 2003 (2003-04-24)

D3 EP 1 136 537 A1 (AKZO NOBEL NV [NL]) 26 September 2001 (2001-09-26)

D4 EP 0 062 389 A1 (METHANOL CHEMIE NEDERLAND [NL]) 13 October 1982 (1982-10-13)

D5 EP 0 025 245 A2 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 18 March 1981 (1981-03-18)

D6 EP 0 107 260 A1 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 2 May 1984 (1984-05-02)

2 The amendments filed with the letter dated 18-04-2013 do not introduce subject-matter which extends beyond the content of the application as filed, (Article 34(2)(b) PCT).

3 The application fulfils the requirements of Article 33(2) PCT.

3.1 D1 (claims 1,5,10) discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol, wherein the hardener part and/or the polymer dispersion part can contain a functionalized polyvinylacetate (PVAc). D1 (page 9, lines 13-15) discloses the amount of urea to be from about 1 to about 15 % by weight of the adhesive system.

The adhesive system of claim 1 of the application comprises less than 0.9 wt % of urea based on the weight of the entire adhesive system.

3.2 D2 (claim 1) discloses an adhesive system comprising a melaminic amino resin and a phenolic resin composition, which comprises an acid. D2 (page 3, lines 17-20) discloses that the"aldehyde to amino compound ratio", which is the molar ratio aldehyde to amino compound used when making the amino resin of the claimed adhesive system, is suitably less than 2.4, preferably from about 0.5 to about 2. 3, most preferably from about 0.7 to about 2. D2 (page 3, lines 29-30) discloses that homopolymers or copolymers of vinylesters, such as vinyl acetate, vinyl propionate, and vinyl butyrate, may also be used as components of the composition.

D2 does not disclose all the components in one single embodiment. D2 also does not discloses the F/NH2 ratio as defined in present claim 1 of the application, namely as molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups.

3.3 D3 (claims 1,10-12) discloses an adhesive system characterised in that it comprises, (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and optionally (d) a polyvinyl alcohol. The polymer (b) is a copolymer of vinyl acetate and N-methylol-acrylamid and the curing agent (c) is a carboxylic acid.

D3 however does not disclose the F/NH2 ratio as defined in claim 1 of the application or any equivalent parameter.

3.4 D4-D6 all relate to UF resins with low F/NH2 ratio to be used for particle board hardened and pressed at elevated temperatures.

However, none of D4-D6 discloses that the adhesive system comprises an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or polyethylene vinylacetate (EVA).

4 The subject-matter of the claims involves the presence of an inventive step (Article 33(3) PCT).

4.1 Technical field and problem of the application.

- technical field: adhesive systems comprising amino resins for producing wood based products
- problem: providing an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

4.2 Document D1 can be selected to represent the closest prior art because D1 (claims 1,5,10) discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol, wherein the hardener part and/or the polymer dispersion part can contain a functionalized polyvinylacetate (PVAc). D1 (page 9, lines 13-15) discloses the amount of urea to be from about 1 to about 15 % by weight of the adhesive system.

4.3 The difference between the closest prior art and the application is that the adhesive system of claim 1 of the application comprises less than 0.9 wt% of urea based on the weight of the entire adhesive system.

4.4 The effect of this difference is shorter press times and low formaldehyde emissions as shown in the examples and comparative examples (description, pages 9-11).

4.5 The objective technical problem in view of the closest prior art can therefore be formulated as providing an adhesive system which results in shorter press times and low formaldehyde emissions.

4.6 This is not obvious for the following reasons:

Starting from D1 the skilled person with the aim of providing an adhesive system enabling both short press time and low emissions would not even consider omitting or lowering the amount of urea because D1 teaches explicitly to work within a range of about 1% to about 15% by weight of the adhesive system. None of the cited documents D2-D6 provides any indication to modify the amount of urea in order to achieve shorter press times and lower formaldehyde emissions. The skilled person starting from D1 would not find the required information to modify the teaching of D1 in order to arrive at the subject-matter of claim 1. Claim 1 thus involves the presence of an inventive step. Claims 2-12 are dependent on claim 1 and thus also involve the presence of an inventive step.

As a consequence the presence of an inventive step can be acknowledged.

Akzo Nobel N.V.
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European Patent Office
Patentlaan 2
2280 HV RIJSWIJK
The Netherlands

April 18, 2013

Your ref: PCT/EP2012/063766
Our ref : SWE11195 WOP1

Re: International Patent Application No. PCT/EP2012/063766
Applicant: Akzo Nobel Coatings International B.V.

Dear Sirs,

Reference is made to the Written Opinion by the International Search Authority pursuant to Rule 43bis.1 PCT dated August 9, 2012 in respect of the above-identified application. Hereby by a new set of amended claims is submitted along with the following observations:

Amendments

Claim 1 has been amended by specifying the polymer to comprise at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA), which is supported by original claim 8. As a consequence, claims 6-8 have been deleted, while claims 9-15 have been renumbered and their dependencies brought into conformance with the new numbering.

Claim 1 has been further amended by including the definition of the F/NH_2 ratio as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, which is supported by the original description page 3, lines 13-15.

Clarity

The objections to the clarity have been overcome by the claim amendments.

The Invention

The present invention relates to an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous dispersion of at least one polymer comprising at

least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA); wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

It has been found that the invention solves the problem of providing an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

Cited documents

D1 = WO 2007/040410

D2 = WO 03/033610

D3 = EP 1136537

D4 = EP 0062389

D5 = EP0025245

D6 = EP 0107260

Novelty

The International Search Authority has asserted that the claims lack novelty since all documents D1-D6 disclose urea based amino resins with the proper F/NH_2 ratio and a hardener compound. However, as will be shown below none of the documents do disclose all features of claim 1.

D1 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

The adhesive system of present claim 1 is distinguished from D1 by specifying that it comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

D2 discloses an adhesive system comprising a melaminic amino resin composition and a phenolic resin composition. The most preferred molar ratio aldehyde to amino compound is from about 0.7 to about 2. However, no preferred F/NH_2 is mentioned for resins predominantly based on urea.

The adhesive system of present claim 1 is distinguished from D2 by the combination of the claimed F/NH_2 ratio in a urea based amino resin (meaning that urea constitutes from 75 to 100 wt% of compounds carrying -NH_2 or -NH groups) and further in combination with a polymer dispersion comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA). Such a combination can only be arrived at by combining several lists and sub-ranges and does constitute a novel selection that is not unambiguously derivable from D2.

D3 discloses an adhesive system comprising an etherified amino resin. However, the F/NH_2 or any equivalent parameter is not disclosed and D3 cannot for this reason anticipate present claim 1.

D4-D6 all relate to UF resins with low F/NH_2 ratio to be used for particle board pressed at very high temperatures. However, none of D4-D6 discloses any

adhesive system comprising a dispersion of a polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA) as recited in present claim 1.

Accordingly, it is evident that none of the cited documents destroy the novelty of present claim 1.

Claims 2-12 include all limitations of claim 1 and are novel for the same reason.

Inventive step

The International Search Authority Examiner has not discussed the inventive step. Nevertheless, it is submitted that there is no ground for lack of inventive step.

Reasonably D1 is regarded as the closest prior art as has the highest amount of structural similarities as the present invention and also relate to the same problem.

As set out above, claim 1 of the present application is distinguished from D1 by specifying that the adhesive system comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

As shown in the Examples of the present application the claimed combination of the specified F/NH_2 and absence of urea gave both short press time and low emissions. On the other hand, with significant amounts or urea in the system, the press time required for giving sufficient bond strength was significantly longer. Furthermore, with systems based on Hardener 4 representing D1 (WO 2007/040410) sufficient bond strength for passing the test was not even reached. Thus, it is apparent that the distinguishing features do solve the problem.

A person skilled in the art starting from D1 and aiming at solving the problem of providing an adhesive system enabling both short press time and low emissions would not even consider omitting or lower the amount of urea since this would go against the entire teaching of D1. Furthermore, none of D2-D6 provides any incentive to go against this teaching in order to solve the above problem. Therefore, claim 1 of the present application cannot have been obvious to a person skilled in the art and does for this reason involve an inventive step.

Claims 2-12 include all limitations of claim 1 and are inventive for the same reason.

Final remarks

In view of the above submissions it is requested that a positive International Preliminary Examination Report is issued for the new claims filed. Should there be any outstanding objections, it is requested that the International Preliminary Examination Authority issues a further Written Opinion or, if such objections are believed to be possible to easily resolve, contacts the undersigned agent for a telephone discussion.

Yours faithfully,

Christer Jönsson
(Association No. 485 – G.A. 598670.8)

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA);

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

7. Adhesive system as claimed in any one of the claims 1-6, wherein the hardener component comprise at least one aluminium salt.

8. Adhesive system as claimed in any one of the claims 1-7, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

9. Adhesive system as claimed in any one of the claims 1-8, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

10. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-9 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

11. Wood based product obtainable by the method according to claim 10.

12. Use of an adhesive system according to any one of the claims 1-9 for joining one or more pieces of a wooden material with one or more further pieces of a material.

INFORMATION DISCLOSURE STATEMENT BY APPLICANT
(Not for submission under 37 CFR 1.99)

Application Number	14131606
Filing Date	2014-01-08
First Named Inventor	Jenny Adrian MEREDITH
Art Unit	1746
Examiner Name	
Attorney Docket Number	13877/48501

U.S.PATENTS

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Examiner Initial*	Cite No	Patent Number	Kind Code1	Issue Date	Name of Patentee or Applicant of cited Document	Pages,Columns,Lines where Relevant Passages or Relevant Figures Appear
	1	4409293		1983-10-11	Williams	

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	1	WO 2007/040410	WO		2007-04-12	DYNEA OY		☐
	2	WO 03/033610	WO		2003-04-24	AKZO NOBEL N.V.		☐
	3	WO 01/70898	WO		2001-09-27	AKZO NOBEL N.V.		☐

INFORMATION DISCLOSURE STATEMENT BY APPLICANT (**Not for submission under 37 CFR 1.99)**	Application Number		14131606
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	First Named Inventor	Jenny Adrian MEREDITH	
	Art Unit		1746
	Examiner Name		
	Attorney Docket Number		13877/48501

	4	WO 02/068178	WO		2002-09-06	DYNEA WOOD AND SPECIALITY ADHESIVES		☐
	5	EP 1136537	EP		2001-09-26	AKZO NOVEL N.V.		☐
	6	EP 0062389	EP		1982-10-13	METHANOL CHEMIE NEDERLAND V.o.F		☐
	7	EP 0025245	EP		1981-03-18	METHANOL CHEMIE NEDERLAND V.o.F		☐
	8	EP 0107260	EP		1984-05-02	METHANOL CHEMIE NEDERLAND V.o.F		☐
	9	EP 0501174	EP		1992-09-02	NATIONAL STARCH AND CHEMICAL S.p.A.		☐

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	1	International Search Report and Written Opinion for International Application No. PCT/EP2012/063766 mailed on August 9, 2012.	☐
	2	International Preliminary Report on Patentability for International Application No. PCT/EP2012/063766 mailed on September 9, 2013.	☐

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INFORMATION DISCLOSURE STATEMENT BY APPLICANT **(Not for submission under 37 CFR 1.99)**	Application Number	14131606
	Filing Date	2014-01-08
	First Named Inventor	Jenny Adrian MEREDITH
	Art Unit	1746
	Examiner Name	
	Attorney Docket Number	13877/48501

EXAMINER SIGNATURE

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(54) Title: LOW EMISSION ADHESIVE SYSTEM

(57) Abstract: An adhesive system comprising the following parts: a) a urea formaldehyde resin adhesive part; b) a hardener part comprising one or more curing agents(s), c) a polymer dispersion; and d) a formaldehyde scavenger, wherein part d) comprises a combination of urea and resorcinol, is described. A formaldehyde scavenger and a process for manufacturing of an adhesive system is also described.

LOW EMISSION ADHESIVE SYSTEM

Field of invention

The present invention relates to field of urea formaldehyde adhesive systems for manufacturing of glued products, where the emission of formaldehyde from the glued product is substantially reduced compared with prior art urea formaldehyde adhesives. More specifically, the invention relates to a modified adhesive system and to a modifier for urea formaldehyde adhesive systems.

Background of the invention

Amino resins such as urea formaldehyde (UF), modified UF and melamine urea formaldehyde (MUF) adhesive systems have been used for decades for gluing of wood based products. These amino resins are used in foliation, veneering, production of MDF, HDF and chipboards, and laminated products, e.g. parquet, furniture boards, solid wood laminates, plywood, curved plywood etc. The composition of the adhesive system is adjusted to meet the criterions for the actual product, such as the quality of the glue line, in addition to economical and practical factors, such as the cost of the adhesive /adhesive system, pot life, assembly time and pressing/hardening time.

Formaldehyde based adhesives will release varying amounts of formaldehyde during production of the glue and during production of the glued products. There will also be some formaldehyde emission from the finished glued product. There are strict regulations on the formaldehyde concentration in working environments and in the living areas (indoor air quality). Maximum limits for emission of formaldehyde in productions facilities and from the glued products are set by different authorities. Accordingly, a substantial effort has been done by several actors in research and in the adhesive industry to reduce the emission of formaldehyde in the production of wooden products and from glued wooden products, without unacceptable increase in cost or loss of quality in the glued products.

The release of formaldehyde from an adhesive is principally determined by the ratio of formaldehyde to urea (F:U) in the adhesive system. Accordingly, considerable efforts have been done to reduce this ratio the last decades. For chipboards this has resulted in a reduction of formaldehyde emission from a level typically about 100 mg/100g before 1970, to the present level of about 5 mg/100g.

According to US 4.409.293 a method for binding a lignocellulose material using an UF adhesive system, wherein the formaldehyde emission is reduced by reducing the F:U ratio to between 1:1 and 1:2, is described. The reduction of the F:U ratio has, however, great impact on the properties of the adhesive. Generally, a adhesive having a low F:U ratio will normally result in a glue line that is more brittle than an adhesive having a higher ratio, lower quality of gluing, i.e. a higher degree of gluing defects, reduced water resistance and reduced strength as well as reduced shelf life of the adhesive. Additionally, a reduction of the F:U ratio results in a reduction of the reactivity of the adhesive, resulting in a prolonged curing time. To increase the curing speed, higher press temperature or addition of more acid or acidic components are necessary. A long curing time, and correspondingly long pressing time, is unwanted as it results in a lower production capacity of a plant. Higher pressing temperatures are unwanted due to higher energy costs and due to the increased risk of the glued product becoming more unstable (more curved). Increased addition of acid/acid components is unwanted since the increased the reactivity of the adhesive system not only shortens the curing speed but also reduces the pot life and assembly time of the system.

An alternative to reduction of the ratio F:U in the adhesive is to add scavengers binding free formaldehyde that is released during the curing of the adhesive. Depending on the type and amount of scavenger added, it can also bind free formaldehyde during the lifetime of the glued product.

It is known to reduce the emission of formaldehyde by binding free formaldehyde with urea, see i.a. US 5.684.118, which is incorporated as reference, see column 1, line 41 to 55. To reduce the emission of formaldehyde sufficiently, urea has to be added in an amount that is detrimental to the wanted characteristics of the adhesive.

In WO 02/072324, which is incorporated as reference, a method of reducing formaldehyde emission from a laminated wooden product glued with UF adhesive is described. At least one of the surfaces to be glued is in a separate step treated with a solution comprising an ammonium salt, before the adhesive is applied. Ammonium salts are known to react with free formaldehyde to bind the formaldehyde in a nonvolatile form. The ammonium salt solution may additionally comprise urea to improve the formaldehyde scavenging effect of the treatment. This method does, however, require an additional process step, adding cost to the finished product.

Use of a low molecular weight melamine urea formaldehyde adhesive as a formaldehyde scavenger is described in the above mentioned US 5.684.118, which is incorporated as reference. The fact that this adhesive has to be prepared separately makes this solution relatively costly.

Another formaldehyde scavenger is described in EP 1 291 389, which is incorporated as reference, where a polyamide, such as various proteins and other oligomeric or polymeric polyamides are added to the adhesive to reduce the formaldehyde emission. In US 2003/0099850, which is incorporated as reference, other polyamides as formaldehyde scavengers for use in formaldehyde based coating adhesives, are described. The polyamides described in US 2003/0099850 are not natural proteins, as natural proteins and longer polyamides tend to give an unwanted increase in the viscosity of the adhesive.

Resorcinol and resorcinol derivatives are known to bind formaldehyde. GB 589,131, which is incorporated as reference, describes the use a formaldehyde fixing agent, such as resorcinol, in a urea formaldehyde resin to avoid premature hardening. Resorcinol is here used to bind formaldehyde that is released from the urea formaldehyde condensation product to avoid a reaction between the ammonium that that is used as a hardener, and free formaldehyde to liberate acid that will initiate hardening of the resin.

The use of resorcinol as formaldehyde scavengers in UF adhesives is also described in “Resorcinol derivatives for scavenging formaldehyde in particleboard”, M.Y. Dietrick and T.F. Terbilcox, Koppers Co., Inc., Monroeville, PA, USA, Proceedings of the Washington State University International Particleboard/Composite Materials Symposium (1983), 17th, 233-48, “Influence of different catalyst systems on the hydrolytic stability of particleboards bonded with unmodified and modified US-adhesives”, T.W. Lee et al, in Holzforchung 48 (1994) Suppl., pages 101-104, and “Modifizierung von Harnstofformaldehydharzen mit Resorcin”, E. Roffael in Adhäsion 1980, Heft 11, pages 422-424, which all are incorporated as reference. Resorcinol is known from the references both as a formaldehyde scavenger and as fortifier for the hardened adhesive. Addition of resorcinol during the condensation reaction for production of the UF resin does, however, lower the reactivity of the adhesive. and increases the cost of the adhesive system

Summary of the invention

An objective of the present invention is to provide a low formaldehyde emission urea formaldehyde based adhesive system for gluing of laminated wood based products. It is also an objective that the formaldehyde emission is low during the use of the adhesive system, and that the emission from the glued products is at very low levels. It is also an objective that the adhesive system fulfills practical requirements set by the industry using the adhesives and the requirements for gluing quality.

According to a first aspect, the present invention relates to an adhesive system comprising the following parts:
a) a urea formaldehyde resin adhesive part;
b) a hardener part comprising one or more curing agents(s),
c) a polymer dispersion; and
d) a formaldehyde scavenger,
wherein part d) comprises a combination of urea and resorcinol. The combination of resorcinol and urea in the formaldehyde scavenger, results in a good formaldehyde scavenging effect, without resulting in negative effects like reduced reactivity of the adhesive system, or reduced quality of gluing.

According to a first embodiment the adhesive system consists of two components:
i) an adhesive component comprising part a),
ii) a hardener component comprising part b), part c) and part d).

Component ii) of a two component system may also comprise an additional carboxylic acid part e). The carboxylic acid improves the gluing quality and the water resistance of the glue line.

According to a second embodiment, the adhesive system comprises three components:
i) an adhesive component comprising part a);

ii) a hardener component comprising part b), and parts of part c), and
iii) a modifying component comprising at least parts of part d) and parts of part c).

Component ii) or component iii) of a three component system may also comprise an additional carboxylic acid part e). The carboxylic acid improves the gluing quality and the water resistance of the glue line.

According to another embodiment, at least parts of part c) is a functionalized PVAc.

According to a second aspect, the present invention relates to a formaldehyde scavenger for urea formaldehyde adhesive systems for reduction of formaldehyde emission from the glued products, wherein the formaldehyde scavenger comprises urea and resorcinol.

According to one embodiment, the formaldehyde scavenger comprises a polymer dispersion.

According to another embodiment, the scavenger additionally comprises a carboxylic acid, preferably lactic acid.

According to one embodiment, the polymer dispersion comprises a functionalized PVAc.

According to a third aspect, the present invention relates to a process for the manufacture of an adhesive system comprising parts (a) to (d) described above, said process comprising the steps of providing a first component i) comprising parts a), and a second component ii) comprising part b) and at least parts of part (c),
wherein the ingredients urea and resorcinol of part d) are added together or separately to the second component ii), and/or are provided as a third component iii) together with at least parts of part c).

In the present description and claims, parts and percentages are given in weight parts and % by weight, respectively, if not specifically indicated otherwise.

Detailed description of the invention

The present invention relates to improvements in existing and traditional UF adhesive systems, where modifying ingredients are added to improve the bonding properties of the system at the same time as the formaldehyde emission is reduced. Normally, a UF adhesive system comprises two components, an adhesive component and a hardener component. The adhesive system according to the present invention may be provided as a three component adhesive system, or a two component system.

The present adhesive system comprises several parts that are combined into a two or three component adhesive system. The parts of the adhesive system are:

a) an urea formaldehyde resin adhesive part,
b) a hardener part,
c) a polymer dispersion part,
d) an urea formaldehyde scavenger part, and optionally
e) a carboxylic acid part.

a) The urea formaldehyde resin adhesive part

The adhesive part of the present adhesive system is a urea formaldehyde (UF) or a modified UF adhesive. The adhesive part has preferably a content of solids from about 65 % to about 75 %. A preferred adhesive has content of solids of about 68-73%.

The adhesive part has a viscosity at 25 °C from about 500 to 10000 mPas, preferably from about 1000 to 4000 mPas, all for a freshly prepared adhesive, depending on the specific use. A specially preferred adhesive has a viscosity at 25 °C of 2500 to 3200 mPas. The molar ratio of formaldehyde to urea (F/U) in an unmodified UF adhesive is preferably in the range from 1,5 to 1,1. A preferred UF adhesive has a molar ratio of about 1,25 to 1,35. In a modified UF adhesive the molar ratio may be higher, e.g. up to about 2.0:1

b) The hardener part

The hardener part of the adhesive system comprises a liquid in which one or more acid(s), acid salt(s) and /or acid generating salt(s) as active component(s) are dissolved. Preferably, the liquid in which the components are dissolved is water.

The selection of acid(s), acid salt(s) or acid generating salt(s) primarily depends on the desired characteristics for the hardener, such as how quickly it is desired that the curing takes place after the hardener and the adhesive are brought together.

Non-limiting examples of preferred acids are phosphoric acid, sulfamic acid, maleic acid, citric acid, formic acid and para-toluene sulphonic acid

Acid salts are in the context of the present invention salts that results in an acidic solution when they are dissolved in water. Non-limiting examples of acid salts are aluminium nitrate, aluminium sulphate and aluminium chloride.

Acid generating salts in the context of the present invention, are salts that react with formaldehyde in the adhesive to generate an acid. Non-limiting examples of acid generating salts are ammonium salts, such as ammonium phosphates, ammonium sulphate and ammonium chloride.

The hardener may have a pH in the range from 0 to 4, preferably from 0.5 to 3.0. To obtain the preferred characteristics, the hardener has to include an acid and an acid salt, an acid and an acid generating salt, or an acid generating salt and an acid salt. The hardener may also comprise an acid in combination with both an acid generating salt and an acid salt. The hardener may also comprise more than one acid, more than one acid generating salt and/or more than one acid salt.

The active ingredients in the hardener are combined in amounts to give the required reactivity and stability of the hardener. The reactivity is determined by the total amounts of acid, acid salts and acid generating salts. The skilled man in the art has the knowledge how to achieve both the required reactivity and the required stability. The relative amounts of the ingredients are often adjusted to the costumers needs.

c) *The polymer dispersion part*

The dispersions used in the present invention is preferably a water based dispersion selected among vinyl adhesives, polyurethane and / or polyacrylate and may comprise one of the mentioned polymers or as a mixture of more than one of the mentioned polymers. The polymers have preferably a molecular weight in the range from about 2000 to about 20000, have a viscosity in the range from 5000 to 40000 mPa*s, more preferably from about 10000 to about 25000 at 23 °C, and the dispersion preferably has a content of solids from 45 to 65 % by weight.

It has been found to especially preferable to use a polyvinylacetate dispersion. Most preferably the PVAc is functionalised. Partly functionalized polymer dispersion may be obtained as such from the supplier or be prepared by mixing two or more polymer dispersions. Preferably, 40 to 100% of the polymer dispersion is functionalized.

The expression “functionalised” is in the present description and claims used in the meaning that the polymer comprises post polymerisation cross-binding groups that may cross-bind with each other or with other ingredients of the adhesive during the curing.

Cross-binding groups may be introduced into vinyl adhesives by introducing small amounts of reactive monomers such as N-methylolacrylamide or triallylcyanurate, to be polymerised with the vinyl adhesive. Polyvinylacetate (PVAc), ethylenevinylacetate and polyvinylpropionate are examples on preferred vinyl adhesives.

Preferred polymer dispersion may be emulsion adhesives, e.g. the emulsion adhesives described in US Patent No. 5.545.684. This polymer dispersion has a pH in the range 2 to 6 and comprises at least one homo- or co-polymer polyvinyl ester, and at least one polymer protective colloid.

Specially preferred as the copolymer are the copolymers that includes N-functional groups, such as (meth)arylamide, allylcarbamate, acrylonitrile, N-methylol(meth)acrylamide, N-methylolallylcarbamate, alcyl ethers and Mannich bases of N-methylol(meth)acrylamide and N-methylolallylcarbamate etc. It is preferred that the amount of these monomers is less than 15% of weight of the total amount of monomers.

The inclusion of polymer dispersion in the adhesive system improves the performance of the adhesive as it improves the characteristics of the hardened adhesive and the adhesive quality.

d) The formaldehyde scavenging part

The UF scavenging part comprises urea and resorcinol.

Urea is added as a formaldehyde scavenger. As mentioned above, urea is a known formaldehyde scavenger that in effect reduces the F:U ratio. Earlier tests performed by the applicant have shown that addition of urea in the adhesive results in undesirable effects. Addition of urea to the adhesive immediately before application of the adhesive results in fewer undesirable effects than addition of urea to the adhesive before delivery to the costumer. Additionally, it has been surprisingly found that addition of urea together with resorcinol and polymer dispersion results in a lower degree of unwanted effects than addition of urea alone. The amount of urea preferably constitutes from about 1 to about 15 % by weight of the adhesive system, more preferably from about 3 to about 10 % by weight.

The present inventors have found that the formaldehyde scavenging effect of urea is reduced during storage of an aqueous solution of UF resin and urea. Accordingly, urea is preferably mixed with the adhesive part shortly before, such as the same day, or during the application of the adhesive to the substrate to be glued. As mentioned above, addition of urea is known to reduce the reactivity of a UF adhesive system. The present inventors have also surprisingly found that this effect is substantially reduced if urea is combined with the UF resin immediately before use of the adhesive system, i.e. within the same day or within a few hours to a few minutes before application.

Resorcinol is added both as a formaldehyde scavenger and to improve the performance of the cured adhesive. As mentioned above, resorcinol and resorcinol derivatives are known as formaldehyde scavengers, additionally resorcinol is known as a fortifier for UF and MUF adhesives. The amount of resorcinol in the adhesive system is preferably from about 1 to about 15 % by weight, more preferably from about 3 to about 10 % by weight of the adhesive system. The present inventors have found that the formaldehyde scavenging effect of resorcinol is reduced during storage of an aqueous solution of UF resin and resorcinol. As mentioned above, addition of resorcinol is known to reduce the reactivity of a UF adhesive system. The present inventors have also surprisingly found that this effect is substantially reduced, and addition of resorcinol may even increase the reactivity of the adhesive system, if resorcinol is combined with the UF resin immediately before use of the adhesive system, i.e. within the same day or within a few hours to a few minutes before application.

e) The carboxylic acid part

The optional carboxylic acid is added to improve the properties of the glue line and to stabilize the modifier or hardener to improve the shelf life thereof. Non-limiting examples on useful carboxylic acids are formic acid, acetic acid, and lactic acid. Lactic acid is a preferred carboxylic acid as it is odorless. If higher reactivity is required, other acids may be preferred. The amount of acid may vary depending on the choice of other components, the choice of acid and the wanted reactivity of the adhesive system. The amount of acid may vary from 0 to about 3 % by weight, preferably from about 1 to about 2 % by weight of the adhesive system. The carboxylic acid may be included in the hardener part or in a separate modifier part.

The adhesive system

The adhesive system is made by combining the parts a) to d) and optionally part e) into a two or three component adhesive system depending on the user's demands and/or preferences. The preferences and/or demands of the user may be determined by the method for application of the adhesive system, the required pot life for the adhesive system or mixture of the parts of the adhesive system, the required reactivity of the adhesive system etc. The skilled man in the art will understand that the ingredients of the different parts have to be selected to the intended use and the intended combination of parts to avoid any unwanted reactions or incompatibility between components after mixing the parts a) to e) into the components of the adhesive system.

Two component adhesive system

A two component adhesive system consists of two components;

i) an adhesive component, and

ii) a hardener component.

As mentioned above, some of the modifying ingredients may not be included, or are preferably not included in the adhesive component i) as it may result in instability, incompatibility and/or unwanted reactions According to a preferred embodiment, the adhesive component i) comprises part a), and the hardener component comprises the parts b) to d) and optionally part e).

Three component adhesive system

A three component system adhesive system consists of three components;

i) an adhesive component,

ii) a hardener component, and

iii) a modifying component.

In a three component adhesive system, the adhesive component i) preferably comprises part a), the hardener component b) preferably comprises part b) and parts of part c), whereas the modifying component iii) preferably comprises part d) in addition to parts of part c). An optional carboxylic part c) may be included in the hardener component ii) or in the modifying component iii).

A separate modifying component iii) makes it possible for the user to purchase standard adhesive and hardener, and modify the system for specific uses by means of different modifying components iii) having different concentration of the components described herein.

To achieve a sufficient concentration of some of the ingredients in the adhesive system, some of the ingredients may be included in more than one component i) to iii). As indicated above parts of part c) may be included both in component ii) and iii) in a three component system. Additionally, parts of the urea and/or resorcinol may be added to the hardener component ii) of a three component system to avoid increasing the volume of the modifying component iii). The optional carboxylic acid part e) may be added to either the hardener component ii) or the modifying component iii) in a three component system.

Both a two and three component system may be applied to the surfaces to be glued separately or premixed. A two component system may be applied by separate application of both components by means of any of the methods for separate application that are known for the skilled man in the art, or may be premixed and applied by any known method for application of a one component or premix adhesive system.

A three component system may be applied to a substrate by separate application of all three components, by premixing component i) and component iii) and apply the resulting adhesive system as a two component system comprising a hardener component ii) and the combined component i) and iii). A three component adhesive system may also be premixed by mixing all components i), ii) and iii) and apply the resulting mixture to the substrate.

The concentration of the different ingredients of the parts a) to e) in the total adhesive system is of vital importance. The concentration of the ingredients in the different components has to sufficient to give the intended resulting concentration adhesive mixture. The preferred concentration of the different ingredients in the adhesive system is given above under the discussion of the part a) to e).

The polymer dispersion, or parts thereof, may also be added to the hardener. The polymer dispersion and the adhesive part can be mixed, but the shelf life of such mixtures are short hence it is not a viable solution. It is therefore preferred that the modifier is added to the adhesive part by the user immediately before application, and not before delivery.

Presently, it is preferred of technical reasons to provide adhesive systems according to the invention for separate application, as three component systems. The three component system may be applied as three separate components e.g by application of strings. If the parts are to be applied by means of rollers, the hardener is usually applied firstly. To avoid transfer of hardener from the substrate to the roller for adhesive application, the layer of hardener applied to the substrate has to be thin. Accordingly, the volume of the hardener part has to be low.

The modifier may alternatively be mixed with the adhesive part before the application. To avoid unwanted reactions between the adhesive component i) and the modifier component iii), the mixing of the two parts is preferably performed immediately before application. Immediately before application is here intended to mean within a few minutes to a few hours before application.

For mix in adhesive systems, i.e. adhesive systems where the components of the adhesive are combined and mixed before application to a substrate to be glued, relative volumes of the components to be mixed is of no relevant. The relevant question is the concentrations of the different ingredients in the final mixture.

Test methods

Test specimens produced in the Examples below, were tested for bond quality and emission of formaldehyde according to the following standard tests.

Initially, a test according to EN 12765 was performed to verify that the gluing results were acceptable. Adhesive mixtures that did not produce test specimens that passed this test were not used for further testing.

Test according to EN 12765:2001, issued by European Committee for Standardization (CEN)

The gluing quality according to durability class C3 was tested. This test comprises three conditioning sequences, dry, cold water and warm water. In all tests the adhesive strength was measured in N/mm^2.

For the dry test, samples were conditioned for 7 days in standard atmosphere (20±2 °C and 65±5% relative humidity) before measurement of the adhesive strength. For the cold water test, the samples were conditioned for 7 days in standard atmosphere and thereafter immersed for one day in water at 20±5 °C before measurement of adhesive strength. For the warm water test, the samples were conditioned for 7 days in standard atmosphere and thereafter immersed for three hours in water at 67±2 °C and then cooled down for two hours in water at 20 ±5 °C, before measurement of adhesive strength. The requirements for the durability class C3 are an adhesive strength of ≥ 10 N/mm^2 in the dry test, ≥ 7 N/mm^2 in the cold water test and ≥ 4 N/mm^2 in the warm water test.

The emission of formaldehyde was tested as follows:

1) Chamber emission test according to EN 717-1

The test samples were placed back to back, edge sealed as described in the standard, wrapped airtight, and shipped to Dansk Teknologisk Institutt (DTI) for testing according to EN 717-1. The standard EN 717-1:2004, issued by European Committee for Standardization (CEN), is included as reference in the present description. The area of the test specimens were corresponding to a total loading rate (i.e. the ratio of test sample surface area excluding the are of the edges, to the volume of the chamber in m^2/m^3) of 1 m^2/m^3, and placed in a chamber having a volume of 225 liters, at 23±0,5 °C, at a humidity of 45 ±3% RH, with an air exchange rate of once per hour, for 9 or 21 days, respectively.

The steady state formaldehyde concentration in the chamber obtained under these conditions was measured by drawing air from the chamber through washing bottles containing water absorbing the formaldehyde. The formaldehyde content of the aqueous solutions was measured photometrical by the acetyl acetone method, to give results in mg/m^3.

The requirements for an E1 classification according to EN 717-1 is an emission lower than 0,124 mg/m^3.

2) Desiccator –test according to JANS 16

The standard, JANS 16:1998, issued by the Joint Japan, Australia and New Zealand Standards Harmonisation Committee, is included as reference in the present description.

Un-lacquered test samples was cut and placed in a desiccator together with a dish with distilled water, in the applicant's conditioning room at a temperature of 20±0,2 °C. The amount of formaldehyde absorbed by the distilled water was determined by the acetyl acetone method to give results in mg/l.

To pass the requirements for F**** according to JANS 16, the mean value for formaldehyde emission from parallel test must not exceed 0,3 mg/l, and no single result may be higher than 0,4 mg/l.

Testing of the bond quality

Knife test

The gluing quality was assessed by inserting a knife into a glue line to split the surface layer from the core layer. The resulting fracture surface was visually inspected and fracture of the wood of the core layer vs. fracture in the glue line as such was assessed by visual inspection of the fracture and the glue line. Results are given in % wood fracture, where 100 % wood fracture indicates a glue line of good quality as there is no fractures in the glue line as such.

Values above 60% are acceptable and values above 80% are very good.

Japanese Agricultural Standard (JAS) for plywood for general use, type II and III

Type II – immersion delamination test

Test samples of three layered parquet cut a size of 75x75 mm were immersed in hot water at temperatures of 70±3 °C for 2 hours and dried in an oven at a temperature of 60±3 °C for three hours before the glue line was investigated for openings / delamination.

Type III – immersion delamination test

Test samples of three layered parquet cut a size of 75x75 mm were immersed in water at temperatures of 35±3 °C for 2 hours and dried in an oven at a temperature of 60±3 °C for three hours before the glue line was investigated for delamination.

For both type II and type III delamination is measured in mm. To pass the tests the delamination must not exceed 1/3 of the glue line for each side, or 25 mm for the test samples used for these tests.

Test for shear strength according to EN 13354:2000, issued by European Committee for Standardization (CEN)

Test samples were tested for shear strength as described in EN 13354. The length and width of the shear area was determined before pretreatment. Test specimens were tested untreated, i. e. without any pre-treatment, after 24 h in water and after 24 hours in water and thereafter drying in an incubator at 35 °C for a week.

The test specimens were positioned in the shearing tool and a shearing force was applied parallel to the adhesive line. The maximal load at failure was noted and shear strength was calculated in N/mm^2. Additionally, the % wood failure was calculated.

To pass the test, the lower 5-percentile of the shear strength calculated in accordance with EN 326-1 shall not be less than 08 N/mm2. The mean percentage wood failure of each panel shall be more than 40%.

Examples

With exception of Example 1, which was performed in the applicant's laboratory, all the tests in the Examples were performed in a regular production line.

The present invention will be further described by means of the following non-limiting examples. Even though only a limited field of use for the present adhesive system and modifier is described, the skilled man in the art will understand that the present gluing system and modifier may be used for different gluing operations and for production of different kind of products. The present gluing system and modifier, without limitations, may thus be used for foliation of wood based products, veneering, in addition to different kinds of lamination, such as production of parquet, plywood, curved plywood, solid wood lamination, and production of beams.

The application method for adhesive and hardener is indicated for all examples. The modifier was mixed with the adhesive as indicated in each example. The substrates to be tested are described in the examples, however, for the examples relating to laminated parquet boards, the boards have a total thickness of 14 mm, comprising a 4 mm surface layer of hardwood, a 8 mm spruce core layer, and a 2 mm spruce backing veneer. The test specimens were produced as 5 layered lamella parquet having a 10 mm surface layer in the middle, a core layer at each side of the surface layer and a backing veneer at each side. After gluing the surface layer was split and planed to give two laminated parquet boards. The surface layer was made of beech, oak or merbau, as indicated in the examples.

After application of adhesive and hardener, the test samples were layered to build up the layered structure as described above for parquet, and introduced to a radio frequency (RF) lamination press where the test specimens were heated by means of high frequency electric power. The heating time is given in the tables below as "RF time". The time after application of heat before the pressure is released and the test specimen is removed from the press, is in the tables referred to as "Post-curing time".

Ingredients

The composition of the modifiers and hardeners are given in the following tables 1 and 2

Table 1: Composition of the modifiers, the amounts are given as % by weight

Modifier **Ingredient**	**1**	**2**	**4**	**5**
Polymer dispersion (Vinnac DPN-36 from Air Products Polymers GmbH & Co. KG), 52% dispersion	49,5	65,9	75,0	
Urea	15,0	21,6	20	15,0
Lactic acid	2,2			
Resorcinol	16,0			16,0
Bonit				16,0
Water	17,3	12,5	5	53

Table 2: Composition of the hardeners, the amounts are given as % by weight

Hardener **Ingredient**	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**I**	**J**
Aluminium chloride- 6-hydrate	5,6	5,6	10,6	3,0	3,0	3,0	2,8	4,0	2,7
Monoammonium phoshate	4,4	3,5	6,6	6,6	6,6	6,6	4,4	4,0	2,3
Polypropyleneglycol	1,5	1,2	2,25	2,2	2,2	2,2	1,5	2,2	0
Polymer dispersion (Vinnac DPN-15 from Air Products Polymers GmbH & Co. KG), 52 % dispersion	60,0	48,4					60,0		0
Polymer dispersion (Vinavil 2252M from Vinavil S.p.A)									61,7
Resorcinol			37,4	15,0	22,4	37,4		37,4	6,5
Defoamer, colour etc.	0,1	0,1	0,2	0,2	0,2	0,2	0,1	0,2	0
Xanthan gum			0,45					0,45	
Urea		18,5							5,8
Lactic acid								5,0	1,1
Water	28,4	22,7	42,5	73,0	65,6	50,6	31,2	46,7	19,9

Example 1 – shear strength test of glued specimens

Gluing tests with hardeners with different resorcinol content were performed to see how much of the relatively expensive resorcinol that had to be added to the adhesive mixture. Additionally, the effect of addition of lactic acid was tested.

Test specimens of beech, 5 mm thick, was glued together and tested for shear strength according EN 12765:2001, as described above.

The mixture of adhesive and any modifier was mixed with hardener before application of about 150 g/m^2 on one side. After a closed assembly time of 2 minutes the test specimens were pressed in a hot press at 100 °C and a pressure of 10 kp/cm^2.

The adhesive Prefere® 4108 was used for all tests. The modifier, the hardener and the parts of each mixture, are given in table 3 below, whereas the results from the shear strength test according to EN 12765, are given i table 4 below.

Table 3 -Amounts of modifier and hardener in the used adhesive mixes

Mixture	Modifier	Hardener	Parts by weight (adhesive/modifier + hardener
1	Modifier 2	D	100/18,5 + 13,3
2	Modifier 2	E	100/18,5 + 13,3
3	Modifier 2	F	100/18,5 + 13,3
4	Modifier 4	F	100/20 + 13,3
5 (reference)	-	G	100/- + 13,3
6	Modifier 2	I	100/18,5 + 13,3

Table 4 – Results from shear strength test according to EN 12765

Adhesive mixture	**Dry test**		**Cold water test**		**Warm water test**	
	N/ mm²	% WF *	N/ mm²	% WF	N/ mm²	% WF
1	14,1	100	6,0	0	1,2	0
2	14,8	76	7,2	0	2,6	3
3	10,7	100	7,5	32	3,5	0
4	12,9	80	6,5	18	4,4	0
5 (reference)	14,7	100	8,7	98	6,6	5
6	13,7	100	7,8	74	7,2	30
Requirements	**10**		7		4	

*) WF is Wood Failure

The results above clearly show that the water resistance is reduced as the level of resorcinol is reduced. The reference adhesive mixture, mixture 5, and mixture 6 give better results than the other mixtures. It is, however, known that the reference mixture will not fulfill the requirements for low formaldehyde emission. Both the reference and mixture 6 fulfills the requirements for shear strength in all three tests with good margin.

These tests clearly illustrates that a high level of resorcinol is necessary to give the required quality of the glue line. The tests does also illustrate that inclusion of lactic acid improves the glue line substantially.

Example 2 – bond quality and emission gluing with standard glue system Prefere ® 4108/5100 (Reference Example)

Prefere® 4108 a urea formaldehyde adhesive, and Prefere ® 5100 hardener (hardener A), both from Dynea Chemicals OY, is a standard glue system used for production of parquet by RF pressing. The following example will describe a standard gluing process using this glue system.

The adhesive and hardener are applied by means of rollers for separate application. Typical values for adhesive and hardener application spread are given in the table below. The necessary heating time (RF time) and pot curing time depend on the RF press used as well as the wood species of the surface layer. Typical values for the RF press used in the examples in the present description are also given in the table below as well as typical surface temperatures of the different wood species after coming out of the press.

Evaluation of bond quality is done as described for the knife test.

Table 5. Typical values

Application rates	RF-time	Post curing time	Surface layer	Evaluation of gluing quality (typical values for the different wood species)
20 to 35 g/ m² of hardener, 130 to 150 g/ m² of adhesive	19-21sec	10-12 sec	Beech	60-80 % wood failure
			Oak	70-100 % wood failure
			Merbau	70-100 % wood failure

Typical formaldehyde emission from samples produced using Prefere ® 4108 and hardener A, as described above, was measured according to EN 717-1 and JANS 16. The results are found in table 6 below.

Table 6: Formaldehyde emission results

Test method	**Surface of specimen**	**Typical result**
Chamber (EN 717-1)	Un-lacquered	0,06 mg/m^3
	Lacquered	0,04 mg/m^3
Desiccator (JANS 16)	Lacquered and un-lacquered	1,0-1,2 mg/l

Example 3 – formaldehyde emission from wood and un-glued parquet

To determine the approximate level of formaldehyde emission from the wood it selves the formaldehyde emission from un-lacquered and un-glued parquet as well as from planed oak lamellas were measured according to EN 717-1. The unglued parquet was held together with staples. The results are found in table 7 below.

Table 7: Formaldehyde emission results

Sample	**Result**
Un-lacquered, un-glued parquet with oak surface, spruce core and spruce veneer	0,0173 mg/m^3
Lacquered, un-glued parquet with oak surface, spruce core and spruce veneer	0,0080 mg/m^3
Planed oak lamellas	0,0124 mg/m^3

Table 7 illustrates that the wood itself will emit some formaldehyde and the level of this emission. It also shows that lacquering reduces the emission. Use of different wood species as surface layer, core layer and backing veneer will have an effect on the formaldehyde emission from the finished parquet. This is due to differences in the formaldehyde content of the wood species as well as the ease of which formaldehyde penetrates though the different wood species. Less formaldehyde will penetrate through a surface layer of a high density wood species compared to a low density wood species.

Example 4 gluing test with and without resorcinol

A gluing test was performed using Prefere® 4108 a urea formaldehyde adhesive, and harderer B (part 1 of the test). A further gluing test was done using Prefere 4108 pre-mixed with modifier 2 and hardener C (part 2 of the test). The mixing ratio of Prefere 4108 and modifier 2 was 100 parts by weight to 18,5 parts by weight. The test was performed in the same production equipment as used in Example 2. The parquet made in these tests had beech surface layer. The adhesive, or adhesive pre-mix in case of test 2, and hardener were applied by means of rolls for separate application. The application was about 140-150 g/m^2 of adhesive and about 20-25 g/m^2 of hardener. The heating time (RF time) in the press was 22 seconds, and the post heat curing time was 10 seconds for test 1 and 24 sec. RF time and 10 sec. post heat curing time in test 2.

A specimen, specimen A, was picked out for test of bond quality and emission testing (chamber emission test and test according to JANS 16) of lacquered and un-lacquered specimens from test 1.

The second specimen, specimen B, was picked out from part 2 of the test for test of bond quality and emission testing (chamber emission test and test according to JANS 16) of lacquered and un-lacquered specimens.

The bond quality of test samples produced above was evaluated and the formaldehyde emission from the test samples was measured according to EN 717-1 and JANS 16. The results are found in table 8 below.

Table 8: Formaldehyde emission results

Test method	**Surface of specimen**	**Results**	
		Specimen A	**Specimen B**
Evaluation of bond quality		30-40 % Wood failure	60-70% Wood failure
Chamber (EN 717-1)	Un-lacquered	0,0445 mg/m^3	0,0215 mg/m^3
	Lacquered	0,0140 mg/m^3	0,0085 mg/m^3
Desiccator (JANS 16)	Un-lacquered	0,832 mg/l	0,592 mg/l

Delamination tests showed that the bond quality of the parquet made in the two tests was not as good as for Prefere ® 4108 and hardener A (as described in example 2). This reduction of the gluing quality as due to a reduced F:U ratio was expected. It was, however, surprising that specimen B (glued with the pre-mix of Prefere 4108/modifier 2 and hardener C) had significantly better bond quality than specimen A (using Prefere 4108 and hardener B).

Both the chamber test according to EN 717-1 and the desiccator test showed that both test specimen A and B had a lower formaldehyde emission than the standard system (Prefere® 4108 / hardener A), where the lowest emission was observed for test specimen B. The emission for the lacquered test specimen B was very close to the results for the lacquered, unglued sample in example 4, i.e. the formaldehyde emission was close to the emission from unglued wood.

As a conclusion, both test specimens A and B had lower formaldehyde emission than the standard system, a result that was expected due to the inclusion of urea as a formaldehyde scavenger. Test specimen B had, however, test results both for formaldehyde emission and gluing quality that was substantially better than for test specimen A. Accordingly, resorcinol seemed to improve both gluing quality and formaldehyde emission and seemed to be necessary to fulfill the requirements both for gluing quality that are demanded by the costumers and the requirements to reduce the formaldehyde emission. The adhesive system including resorcinol was therefore the preferred system, even if resorcinol is expensive and adds cost to the adhesive system.

Example 5 – Gluing test on different substrates

Tests were performed using Prefere® 4108 adhesive, modifier 1 and hardener A. Additional test was performed using modifier 5 where PVAc is substituted by an organic filler known to give good gluing, Bonit® (Wetzel GmbH & Co KG, Germany), and water.

To give the adhesive pre-mix more time to penetrate into the wood, hardener A, having a lower reactivity than the hardener C used in Example 4, was used. The surface layer was made of beech, oak or merbau, as indicated in the tables.

The hardener application was 25-30 g/m^2 and the glue application was 140-150 g/m2.

Table 9

Surface layer	RF-time]	Post curing time	Evaluation of bond quality
Beech	17 sec	13 sec	100 % wood failure
Oak	17 sec	13 sec	70-100 % wood failure
Merbau	17 sec	13 sec	80-100 % wood failure

As illustrated in the table very good bonding was obtained in this test. It was surprising to find that the gluing results were comparable with or even better than the results obtained in the reference Example 2, even with shorter RF times. Contrary to what was expected, the reactivity of the adhesive system seemed to be at the same level or even higher than what was observed in Example 2.

A further test where the modifier was substituted by a less expensive modifier, modifier 5, wherein PVAc was substituted with Bonit® and water, was performed. The adhesive and modifier was mixed in the ratio 100/20 to give an adhesive premix. The results from this test are given in table 10, below.

Table10. Test of modifier 4,

Surface layer	RF-time	Post curing time	Evaluation of bond quality
Beech	21 sec	9 sec	100 % wood failure
Oak	21 sec	9 sec	60-70 % wood failure
Merbau	17 sec	13 sec	60-70 % wood failure

Table 10 illustrates that the reactivity of this adhesive system was higher than in example 2.

The results from this tests confirms that the quality of gluing achieved with Prefere® 4108 adhesive, modifier 1 and hardener A in production of parquet was at least as good as with the standard system, i.e. Prefere 4108 adhesive and hardener A. The gluing achieved in this test for modifier 5, without PVAc, is good, but not as good as for the modifier 1, with PVAc.

Further test of selected test specimens

Selected test specimens glued with Prefere® 4108 / modifier 1 and hardener A, and with the reference system, i.e. Prefere® 4108 and hardener A, were tested further.

The reference specimen, having a merbau surface layer, was taken from normal production with the reference adhesive system. For the testing of bond quality the test specimen H and I, both having merbau surface layer were used. Samples for test of formaldehyde emission were also collected (specimen J, K, L). All the specimens were collected from different parquet boards.

The quality of gluing was tested according to JAS type II and III, and drying / delamination and shear strength test according to EN-13354. Formaldehyde emission was tested according to JANS 16. The results from the tests are given in tables 11, 12, 13, 14 and 15, below.

Table 11 Results from test according to JAS type II

Test	**Ref.**	**Specimen H**
1, surface layer	0-0-0-0	42-0-0-27
1, backing veneer	75-75-75-75	15-0-0-10
Result**	OK/ -	-/ OK
2, surface layer	0-0-0-0	0-0-0-0
2, backing veneer	68-75-75-75	0-0-0-0
Result**	OK/ -	OK

** results are indicated as OK or – (not OK) for surface layer / backing veneer

The gluing between the backing veneer and core layer seems to be better using the present adhesive system than the reference adhesive system.

Table 12 Results from test according to JAS type III

Test	Ref.	Specimen H	Specimen I
1, surface layer	0-0-0-0	0-0-0-0	0-0-0-0
1, backing veneer	0-0-0-0	0-0-0-0	0-0-0-0
Result**	OK	OK	OK
2, surface layer	0-0-0-0	0-0-0-0	5-0-0-0
2, backing veneer	0-0-0-0	0-0-0-0	0-0-0-0
Resultat**	OK	OK	OK

** results are indicated as OK or – (not OK) for surface layer / backing veneer

All the test specimens fulfilled the requirements according to JAS III with good margin.

3) Heat/ delamination test

A 5 cm wide strip was cut and placed in an oven at 100 °C for 30 minutes, before evaluation of delamination. The results are given in mm and %.

Table 13 Results from heat / delamination test

Test	Ref.	Specimen H
mm delam.	0	0
% delam	0 %	0 %

There were no delamination neither for the reference nor for the test specimen.

4) Shear strength according to EN-13354

Table 14 Results in N/ mm² and % wood fracture (WF) (mean values):

Test	Reference		Specimen H		Specimen I	
	N/ mm²	% WF	N/ mm²	% WF	N/ mm²	% WF
Dry	6,28	95	6,05	91	6,64	89
24 h water	2,04	63	3,05	80	2,39	63
One week at 35 °C	4,06	94	4,19	81	3,91	66

The differences between the three tests were relatively small, and the bond quality was not reduced compared with the reference system.

5) Desiccator test according to JANS 16

Test samples was cut in the correct dimensions for testing and conditioned in a conditioning room at 20 °C and a humidity of 65% in cleaned air for 5 to 6 days before testing in an desiccator in the applicant's laboratory.

Table 15 Results from JANS 16 of test samples

Test	**Surface layer (un-lacquered)**	**Emission**
Specimen J	Beech	0,67 mg/ l
Specimen K	Oak	0,64 mg/ l
Specimen L	Oak	0,52 mg/ l

The test results were very promising, thus a more extensive test was performed to confirm the good gluing quality and the low emission result. This is described in the following example 6.

Example 6

In all tests in this example, 100 parts of the adhesive part, Prefere® 4108 adhesive and 20 parts of modifier 1 were mixed manually to produce a premix, before this premix was introduced into the roller spreader for the adhesive part. About 21 – 23 g/m^2 of the hardener and about 140 g/m^2 of the premix were applied by means of standard roller spreaders to the surfaces.

After application of hardener and premix to the surfaces to be glued, the test specimens were pressed and heated in the standard production RF press. The RF time was adjusted to 19 seconds and the post press time was 10 seconds. The results of the bond quality tests are found in table 16, below.

Table 16 Assessment of the bond quality for parquet with surface layer of oak, beech and merbau

Type of wood	Bond quality the day after pressing
Oak	80-100 % wood failure
Beech	70-90 % wood failure
Merbau	90-100 % wood failure

All test samples showed very good bond quality.

Samples from the test production were tested for formaldehyde emission according to JANS 16 and EN 717-1. The results are given in table 17 below. Before the test the test samples were conditioned in a chamber with 1 m^3 purified air at 20 °C and a relative humidity of 65%.

Table 17. Results from JANS 16 and EN 717-1 test for formaldehyde emission

	Surface layer	Surface treatment	Results
JANS 16	Oak	Un-lacquered	0,39 mg/ l
EN 717-1	Merbau	Un-lacquered	0,015 mg/m^3

Example 7

Test samples of edge glued boards having a thickness of 21 mm were produced using a two component system according to the present invention. The test boards were compared with standard production edge glued boards from the same production facility.

The test boards were glued with a standard UF resin adhesive, Prefere® 4134 from Dynea OY and hardener B, being a combined hardener and modifier. The test boards were compared with boards glued with the UF resin adhesive Prefere® 4580 and hardener Prefere® 5109, both from Dynea OY. The test samples where produced from lamellas having a width of 45 mm, whereas the comparison sample was made from lamellas having a width of 42 mm.

The adhesive part and the hardener part of the adhesive systems were mixed before application. Prefere® 4134 and Hardner J were mixed in a ratio of 100/50, whereas Prefere ® 4580 and Prefere® 5109 were mixed in a ratio of 78/22. After application of the glue the lamellas, the lamellas were brought together and pressed at a temperature of 120 °C. The two test samples were pressed for 100 and 121 seconds, respectively, whereas the comparison sample was pressed for 121 seconds. After pressing the two test samples were left for 30 minutes before they were wrapped into plastic. The comparison sample was wrapped into plastic after an unknown time (substantially longer than 30 minutes). The wrapped samples were transported to the applicants laboratory, cut into test pieces of 5 x 15 cm, each having two longitudinal glue lines and tested in a desiccator test according to JANS 16.The emission test results are found in table 18 below.

Table 18. Emission test results

Test sample	Pressing time (sec)	Emission test results (mg/l)
Test sample a)	121	0,33
Test sample b)	100	0,25
Comparison sample	121	0,79

As shown in table 18, the formaldehyde emission from both test sample a) and b) were substantially lower than the emission from the comparison sample. The comparison sample was stored longer than the test samples before it was wrapped into plastic. According to the experience of the applicant this will normally lower the emission test results. Accordingly, it is expected that the emission test results for the comparison sample would have been higher if it had been treated as the test samples The fact that thinner lamellas are used in the reference comparison example than in test sample a) and b) is not expected to have any influence on the emission results.

It is also observed from the table that the test samples seems to pass the requirements for F**** (max value of 0,4 mg/l, average 0,3 mg/l).

CLAIMS

1.

An adhesive system comprising the following parts:

a) a urea formaldehyde resin adhesive part;

b) a hardener part comprising one or more curing agents(s),

c) a polymer dispersion; and

d) a formaldehyde scavenger,

wherein part d) comprises a combination of urea and resorcinol.

2.

The adhesive system according to claim 1, wherein the adhesive system consists of two components:

i) an adhesive component comprising part a),

ii) a hardener component comprising part b), part c) and part d) .

3.

The adhesive system according to claim 2, wherein component ii) comprises an additional carboxylic acid part e).

4.

The adhesive system according to claim 1, wherein the adhesive system comprises three components:

i) an adhesive component comprising part a);

ii) a hardener component comprising part b), and parts of part c), and

iii) a modifying component comprising at least parts of part d) and parts of part c).

5.

The adhesive system according to claim 1, wherein component ii) or component iii) additionally comprise an additional carboxylic acid part e).

6.

The adhesive system according to any of the claims 1 to 5, wherein at least parts of part c) is a functionalized PVAc.

7.

A formaldehyde scavenger for urea formaldehyde adhesive systems for reduction of formaldehyde emission from the glued products, wherein the formaldehyde scavenger comprises urea and resorcinol..

8.

The formaldehyde scavenger according to claim 7, wherein the formaldehyde scavenger comprises a polymer dispersion.

9.

The formaldehyde scavenger according to claim 7 or 8, wherein the scavenger additionally comprises a carboxylic acid, preferably lactic acid.

10.

The formaldehyde scavenger according to any of the claims 7 or 9, wherein the polymer dispersion comprises a functionalized PVAc.

11.

A process for the manufacture of an adhesive system comprising parts a) to d) according to any of the claims 1 to 6, said process comprising the steps of providing a first component i) comprising parts a), and a second component ii) comprising part b) and at least parts of part (c),
wherein the ingredients urea and resorcinol of part d) are added together or separately to the second component ii), and/or are provided as a third component iii) together with at least parts of part c).

INTERNATIONAL SEARCH REPORT

International application No
PCT/NO2006/000343

A. CLASSIFICATION OF SUBJECT MATTER
INV. C09J161/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C09J C08L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, INSPEC, COMPENDEX

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 501 174 A1 (NAT STARCH CHEM SPA [IT] NAT STARCH CHEM INVEST [US]) 2 September 1992 (1992-09-02) examples	1-11
A	GB 589 131 A (ARTHUR MARK HOWALD; LIBBEY OWENS FORD GLASS CO) 12 June 1947 (1947-06-12) cited in the application claims; examples	1-11
A	US 4 409 293 A (WILLIAMS JAMES H [US]) 11 October 1983 (1983-10-11) cited in the application examples	1-11

☐ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

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"&" document member of the same patent family

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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Patent document cited in search report		Publication date	Patent family member(s)			Publication date
EP 0501174	A1	02-09-1992	DE	69211180	D1	11-07-1996
			DE	69211180	T2	06-02-1997
			DK	501174	T3	24-06-1996
			ES	2088033	T3	01-08-1996
			IT	1244634	B	08-08-1994
GB 589131	A	12-06-1947	NONE			
US 4409293	A	11-10-1983	CA	1225916	A1	25-08-1987

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(54) Title: METHOD OF GLUING WOOD BASED MATERIALS

(57) Abstract: The present invention relates to a method of gluing wood based materials by providing an adhesive system onto wood based materials followed by curing, the adhesive system comprises a melaminic amino resin and a phenolic resin composition, wherein the phenolic resin composition comprises an acid and a phenolic resin. The invention also relates to an adhesive system and a stable phenolic resin composition as well as wood based products obtainable by the method or through the use of the adhesive system.

METHOD OF GLUING WOOD BASED MATERIALS

The present invention relates to a method of gluing wood based materials whereby an adhesive system comprising a melaminic amino resin and a phenolic resin composition comprising an acid and a phenolic resin are provided onto wood based materials and cured. The present invention also relates to an adhesive system and a stable phenolic resin composition. Furthermore, it also relates to a wood based product obtainable by the method. Finally, it relates to the use of an adhesive system for making a wood based product.

Background

When gluing wood, it is common to use an adhesive system based on a curable resin, such as a formaldehyde resin, which, for example, can be an amino resin or a phenolic resin. Important properties of an adhesive include adhesive strength, curing time and temperature, water-resistance and emission of formaldehyde.

High water-resistance is especially required for some glued wooden products, such as laminated beams, plywood, and other products for outdoor use. Melaminic amino resin adhesives, and also phenolic resin based adhesives, are commonly used when high water-resistance is required. The advantages of using amino resin based adhesives over phenolic resin based ones are, for example, a much less coloured bondline and less environmental impacts since some phenolic resins need paraformaldehyde to cure.

Melaminic amino resins are condensates of carbonyl compounds, such as aldehydes, with melamine, or a combination of melamine with other compounds containing amino, imino or amide groups. The most common melaminic amino resins are condensates of formaldehyde and melamine alone, or melamine and urea giving melamine-formaldehyde ("MF") and melamine-urea-formaldehyde ("MUF"). A MUF resin can also be made by mixing an MF resin and a UF resin. Melaminic amino resins are usually cured by using acidic hardener compositions.

Emission of free aldehyde, particularly formaldehyde, from adhesives based on melamine based resins and phenolic based resins is a growing concern. Formaldehyde is to various extent present in formaldehyde based melaminic amino resins as free formaldehyde but also further emitted from the resins during curing. This gives environmental problems, both before curing during handling and application of the resin, and emission problems from the finished products after curing. Phenolic resins may also emit formaldehyde during curing and during handling of the resin.

JP Laid Open No. 1977-51430, discloses an adhesive composition for manufacturing plywood comprising a melamine resin and a resol-type phenolic resin. However, there is nothing mentioned about any reduction of formaldehyde emission.

Aldehyde emission from an adhesive system can be reduced by using various additives which act as catchers for the aldehyde. However, such additives do not generally themselves possess any adhesive properties. Thus, the quality of the adhesive bond may be negatively effected. Furthermore, these additives may take part in unwanted reactions with other components of the adhesive system, and addition of such additives also often creates a more complex formulation procedure.

Thus, it is desirable to provide a method of gluing wood based materials, and an adhesive system, which gives low emission of aldehyde, and high quality adhesive bonds.

Therefore, it is an object of the present invention to provide a method for gluing wood based materials which gives low emission of aldehyde. It is another object of the present invention to provide an adhesive system, as well as a phenolic resin composition intended for use in an adhesive system, which gives low emission of aldehyde. Finally, it is an object of the present invention to provide a wood based product which gives low emission of aldehyde.

The Invention

It has surprisingly been found possible to meet these objects by a new method of gluing wood based materials using a new adhesive system and a new stable phenolic resin composition. The method according to the invention comprises gluing wood based materials by providing an adhesive system onto wood based materials followed by curing, the adhesive system comprising a melaminic amino resin and a phenolic resin composition, wherein the phenolic resin composition comprises an acid and a phenolic resin, which is a resorcinol resin or a tannin resin, or a mixture thereof. The adhesive system according to the invention comprises a melaminic amino resin, and a phenolic resin composition, wherein the phenolic resin composition comprises an acid and a phenolic resin, which is a resorcinol resin or a tannin resin, or a mixture thereof. The stable phenolic resin composition according to the invention comprises an acid and a phenolic resin, which is a resorcinol resin or a tannin resin, or a mixture thereof. The invention further relates to a wood based product obtainable by the method which can be a flooring material, plywood, a laminated beam and a fibre-, chip- or particleboard material. Finally, the invention relates to the use of an adhesive system for making a wood based product which can be a flooring material, plywood, a laminated beam and a fibre-, chip- or particleboard material.

The present invention provides a phenolic resin composition which is storage stable before mixing with a curable resin.

By the term “adhesive system”, as used herein, is meant a curing formulation containing one or more curable resins and one or more curing agents.

By the term “melaminic amino resin”, as used herein, is meant an amino resin where melamine is at least one of the raw materials used when making the resin.

The combination of a melaminic amino resin with a phenolic resin composition according to the invention makes it possible to provide an adhesive system with low emission of formaldehyde.

A further advantage with the present invention is that melaminic amino resins, having very low contents of free formaldehyde, can be used in order to achieve adhesive bonds with high quality.

The melaminic amino resin used in the method and the adhesive system of the invention can be any melaminic amino resin, such as melamine-formaldehyde (“MF”), melamine-urea-formaldehyde (“MUF”), melamine-urea-phenol-formaldehyde (“MUPF”), and condensates of formaldehyde and melamine together with any other compounds containing amino, imino or amide groups such as thiourea, substituted urea, and guanamines. The preferred melaminic amino resin is MF. The melaminic amino resin can also be an etherified resin. The “aldehyde to amino compound ratio”, which is the molar ratio aldehyde to amino compound used when making the amino resin of the claimed adhesive system, is suitably less than 2.4, preferably from about 0.5 to about 2.3, most preferably from about 0.7 to about 2. The amount melamine of total amount amino compounds used when making the amino resin is suitably from about 10 to 100 mole %, preferably from about 30 to about 100 mole %, most preferably from about 50 to about 100 mole %. Optionally, fillers, thickeners or other additives, including aldehyde catchers, can be added to the amino resin. Examples of fillers are inorganic fillers such as kaolin and calcium carbonate or organic fillers such as wood flour, wheat flour, starch and gluten. Examples of thickeners are polyvinyl alcohol, and cellulose compounds such as hydroxy ethyl cellulose and carboxy methyl cellulose. Other additives can be, for example, polyols, polysaccharides, polyvinylalcohol, acrylates, and styrene-butadiene polymers. Homopolymers or copolymers of vinylesters may also be used as components, such as vinyl acetate, vinyl propionate, and vinyl butyrate. These polymers may also comprise post-crosslinking groups. Also aldehyde catchers such as urea and guanamines may be added. If components, like fillers or other additives, according to above, are present, their amount can usually be less than about 70 weight %, suitably from about 0.1 to about 70 weight %, preferably from about 1 to about 60 weight %, most preferably from about 5 to about 40 weight %.

Condensates of different phenolic compounds and aldehydes are referred to as phenolic resins. The phenolic compound can be phenol itself, polyhydric phenols, and aliphatically or aromatically substituted phenols. Examples of phenolic compounds are alkyl phenols such as resorcinol, alkyl resorcinol, cresols, ethyl phenol and xylenol, and also phenolic compounds of natural origin such as tannins, cardenol, and cardol. Examples of suitable aldehydes include formaldehyde, acetaldehyde, glutaraldehyde, propionaldehyde, n-butyraldehyde, isobutyraldehyde and furfural. As phenolic resins are herein also included tannins themselves, without having formed condensates with aldehydes. Examples of tannins are condensed tannins, such as bi-, tri, and tetraflavanoids, and further condensed flavanoids. The phenolic resin in the present invention is a resorcinol resin or a tannin resin, or a mixture thereof. The phenolic resin can exist as a solution in water, or alcohol such as ethanol. Tannins can also be present as solid materials. Suitably, the phenolic resin exists as an aqueous solution with varying dry content of resin. Suitably, the phenolic resin is a formaldehyde-based phenolic resin. Preferred formaldehyde based phenolic resins in the phenolic resin composition are resorcinol-formaldehyde ("RF"), phenol-resorcinol-formaldehyde ("PRF"), and tannin-formaldehyde ("TF") resins. The most preferred being PRF. In the case of RF and PRF resins, the molar ratio of formaldehyde to total amount phenolic compounds (one or both of phenol and resorcinol) in the PRF resin, calculated as added when making the resins, can be from about 0.1 to about 2, suitably from about 0.2 to about 1.5, preferably from about 0.3 to about 1. The molar ratio phenol to resorcinol in the PRF resin, calculated as added when making the PRF resin, can be from about 0.02 to about 15, suitably from about 0.05 to about 10, preferably from about 0.1 to about 5, most preferably from about 0.2 to about 2. Alternatively, the PRF resin can be a substantially PF resin, containing substantially no resorcinol, of a resol type having resorcinol grafted onto it as terminal groups.

Examples of suitable acids include organic and inorganic protonic acids, acidic salts, and acid generating salts. As acid is also meant metal salts giving acidic reaction in aqueous solutions, also referred to herein as non-protonic acids. Examples of suitable non-protonic acids include aluminium chloride, aluminium nitrate and aluminium sulphate. Suitable organic protonic acids include aliphatic or aromatic mono-, di-, tri-, or polycarboxylic acids such as formic acid, acetic acid, maleic acid, malonic acid and citric acid. Also sulphonic acids such as para-toluene sulphonic acid, para-phenol sulphonic acid and benzene sulphonic acid are suitable. Inorganic protonic acids can be, for example, hydrochloric acid, sulphuric acid, nitric acid, phosphoric acid, boric acid, sulphamic acid and ammonium salts such as ammonium chloride and ammonium sulphate. Examples of acid generating salts are formiates and acetates such as sodium formiate, sodium acetate, ammonium formiate, and ammonium acetate. A strong acid such as hydrochloric acid or sulphuric acid may be combined with an alkyl amine in the phenolic resin composition thereby forming an alkyl amine salt. The phenolic resin composition may comprise more than one acid, for example, two, three or several acids. Also, the phenolic resin composition may comprise a combination of both an organic acid and an inorganic acid. Suitably, the acid is soluble in the phenolic resin, and solutions of the phenolic resin. In some cases, one or more additives, which improve the solubility of the acid in the phenolic resin, are suitably used. Such additives can be polyglycols such as polyethylene glycol, polypropylene glycol, ketones such as acetone, and dialkyl ethers such as ethylene glycol monobutyl ether, diethylene glycol monobutyl ether, propylene glycol monomethyl ether, diethylene glycol monomethyl ether, and, dipropylene glycol monomethyl ether. Acids suitable in the phenolic resin composition depends partly on the type of structure to be glued. For example, applications such as gluing laminated beams benefits from the use of volatile acids, which evaporates off from the adhesive layer. By the term "volatile acid" is herein meant an acid having a low boiling point, and/or having a high vapour pressure at room temperature. Said acids should suitably have a vapour pressure of more than 10 mm Hg at a temperature of up to 60 °C. Examples of organic volatile acids include formic acid, acetic acid and pyrovic acid. Suitable inorganic acids include, for example, hydrochloric acid. Preferably, formic acid is used as a volatile acid.

In a preferred embodiment of the invention, a combination of a MF resin with a phenolic resin composition comprising a PRF resin and formic acid, gives an adhesive system which gives low emission of formaldehyde.

The phenolic resin composition may, optionally, comprise fillers, thickeners or other additives. These can be inorganic fillers such as kaolin and calcium carbonate or organic fillers such as wood flour, wheat flour, starch and gluten. Examples of thickeners are polyvinyl alcohol, and cellulose compounds such as hydroxy ethyl cellulose and carboxy methyl cellulose. Other additives can be, for example, polyols, polysaccharides, polyvinylalcohol, acrylates, and styrene-butadiene polymers. Homopolymers or copolymers of vinylesters such as vinyl acetate, vinyl propionate, and vinyl butyrate, may also be used as additives, and also aldehyde catchers such as urea and guanamines.

The phenolic resin composition should preferably be storage stable meaning that substantially no curing of the phenolic resin should take place in the phenolic resin composition itself. An indicator for storage stability is the degree of gelling, either occurring evenly throughout the phenolic resin composition, or as lumps of gelled particles in the composition. Gelling throughout the composition gives an increased viscosity. The phenolic resin composition is considered storage stable if it has not gelled according to the above and if it functions in the application equipment used for applying the composition onto wood based materials. The stable phenolic resin composition according to the invention is suitably storage stable at room temperature (20°C) for more than about two weeks, preferably more than about one month, most preferably more than about six months.

The content of phenolic resin in the phenolic resin composition can be from about 1 to about 80 weight %, based on dry matter, suitably from about 5 to about 70 weight %, preferably from about 10 to about 65 weight %, and most preferably from about 20 to about 60 weight %. The content of the acid in the phenolic resin composition depends on the original pH of the phenolic resin itself used in the phenolic resin composition. The content of the acid, including its salts, in the phenolic resin composition can be up to about 50 weight %, suitably from about 0.5 to about 50 weight %, preferably from about 1 to about 40 weight %, and most preferably from about 2 to about 30 weight %. If other components, like fillers or other additives, are present, their amount can usually be less than about 70 weight %, suitably from about 0.1 to about 70 weight %, preferably from about 1 to about 60 weight %, most preferably from about 5 to about 40 weight %. The pH of the phenolic resin composition is suitably from about 0 to about 6, preferably from about 0 to about 4, even more preferably from about 0.1 to about 3, most preferably from about 0.3 to about 2.

The pH of the adhesive system will effect the curing rate of the adhesive system and may be chosen thereafter. The pH of the adhesive system can be from about 0 to about 7, preferably from about 0 to about 5, and most preferably from about 0 to about 4.

Depending on the wood based materials to be glued as well as the way of providing the adhesive system onto the wood based materials, the preferred weight ratios of amino resin to phenolic resin may vary. The weight ratio amino resin to phenolic resin in the adhesive system can be from about 0.1 to about 30, based on dry matter, suitably from about 0.2 to about 10. In a preferred embodiment of the invention, the weight ratio amino resin to phenolic resin, based on dry matter, in the adhesive system is preferably from about 0.5 to about 2. Among suitable uses for this range is, for example, the production of a laminated beam. In another preferred embodiment of the invention, the weight ratio amino resin to phenolic resin, based on dry matter, in the adhesive system is preferably from about 2 to about 10. Among suitable uses for this range is, for example, the production of a flooring material.

The curing temperature, in the glue line, for the adhesive system of the present invention is suitably from about 0 to about 120°C. If no high frequency curing is used, the curing temperature is preferably from about 5 to about 80°C, most preferably from about 10 to about 40°C.

The wood based materials according to the method of the invention can be of any kind that can be joined by an adhesive system, including fibres, chips and particles. Suitably, the wood-based materials are layers in a flooring material such as parquet flooring, the layers in plywood, parts in laminated beams, or fibres, chips and particles for making fibre-, chip-, or particleboard material. Preferably, the wood-based materials are parts in laminated beams.

In the method of the present invention, the adhesive system can be provided by separately applying the amino resin and the phenolic resin composition onto the wood based materials. Alternatively, the method of the invention can comprise mixing the amino resin and the phenolic resin composition to form the adhesive system and then providing the adhesive system onto the wood based materials.

Separate application include, for example, application of the amino resin onto one or several wood based materials and application of the phenolic resin composition onto one or several wood based materials onto which no amino resin have been previously applied. Thereafter, the wood based materials onto which only amino resin has been applied and the wood based materials onto which only phenolic resin composition has been applied are joined together providing a mixing of the two components forming an adhesive system which can be cured. Separate application also include, for example, application of the amino resin onto one or several wood based materials and application of the phenolic resin composition onto the same wood based materials. The amino resin and phenolic resin composition may be applied completely onto each other, partially onto each other, or without being in contact with each other. The surface of the wood based material with both amino resin and phenolic resin composition applied is thereafter joined with another surface of a wood based material, which also may have been applied with both amino resin and phenolic resin composition, thereby providing a good mixing of the amino resin and the phenolic resin composition forming an adhesive system which can be cured. Separate application of the amino resin and the phenolic resin composition can be made in any order onto the wood based materials to be glued.

Suitable amounts of the components to be applied can be in the range of 100-500 g/m^2 depending, inter alia, on the feeding rate of a moving substrate.

The application of the amino resin and phenolic resin composition, or the mixture of both, onto a wood based material can be made by using any suitable method known in the art, such as spraying, brushing, extruding, roll-spreading, curtain-coating etc. forming shapes such as droplets, one or several strands, beads or a substantially continuous layer.

In the case of gluing together wood materials in the form of fibres, chips or particles, the amino resin and the phenolic resin composition is suitably applied as a mixture which coats the wood based materials with the adhesive system.

The wood based product according to the invention is suitably a laminated beam, plywood, a fibre-, chip- or particleboard, or a flooring material. Preferably, the wood based product is a laminated beam.

The invention will now further be described in connection with the following examples which, however, not should be interpreted as limiting the scope of the invention.

Examples

Example 1: Three different phenolic resin compositions were made: PRF resin and pTSA (the present invention), tannin and pTSA (the present invention), and PF resin and pTSA. The PRF resin had a dry content of 55 weight %. The tannin was of a type extracted from Quebracho wood and present as a solid powder. The PF resin was of a resol type, having a dry content of 47 weight %.

Table 1.

Phenolic resin composition	Phenolic resin content, wt%	pTSA content, wt%	Stability
PRF + pTSA	48	6.4	Excellent
tannin + pTSA	36	22.7	Excellent
PF + pTSA	45	27.8	Insufficient (< 1 week)

It is concluded that:

- A PF resin of a resol type does not form a stable phenolic resin composition.
- PRF and tannin resin form stable phenolic resin compositions.

Example 2: An MF resin was combined with a phenolic resin composition according to the present invention. The MF resin had a formaldehyde to melamine ratio of 2. The PRF resin had a dry content of 55 weight % and the molar ratio of formaldehyde to phenol and resorcinol when making the resin was 0.53. The weight ratio MF to PRF was 1.2. The stable phenolic resin composition according to the present invention comprised formic acid in an amount of 20 weight %. The adhesive system above was compared with single resin MF and PRF systems having conventional, i.e., acid based and paraformaldehyde based hardeners. Here, the MF resin had a formaldehyde to melamine ratio of 2, the PRF resin had a dry content of 55 weight %, and the molar ratio of formaldehyde to phenol and resorcinol when making the resin was 0.61. The emission of formaldehyde was measured as direct emission, during 150 minutes, from 5 g of a mixture (before curing) of the MF- and PRF resin with respective hardeners and the MF resin with the phenolic resin composition according to the invention.

Formaldehyde emission from glued structures was also tested according to an internal method (IAR 129) based on JAS MAFF992. For each adhesive system, five plies (150 x 150 mm) of fir were glued together with 380 g/m^2 of a mixture of adhesive system components: MF with conventional acid hardener, PRF with conventional paraformaldehyde hardener, and MF resin with the phenolic resin composition according to the invention. The laminate was pressed at 0.8 MPa for 12 hours at 20°C and subsequently conditioned at 20 °C at 65% relative humidity for one week. Pieces of 25x10x75 mm were cut out and put in a 4 litre chamber where also a small container with 20 ml of water was put. After 18 hours at 23°C the content of formaldehyde in the water was measured.

Table 5.

	Direct formaldehyde emission (mg/l)	Formaldehyde emission (IAR 129, mg/l))	Water resistance standard EN 301
MF + (PRF + formic acid)	0.06	4.9	pass
MF + acid hardener	0.33	5.8	pass
PRF + paraformaldehyde hardener	0.13	9.8	pass

It is concluded that the present invention gives lower emission of formaldehyde than when using an MF resin or a PRF resin alone with conventional hardeners.

CLAIMS

1. A method of gluing wood based materials by providing an adhesive system onto wood based materials followed by curing, the adhesive system comprising a melaminic amino resin and a phenolic resin composition, characterised in that the phenolic resin composition comprises an acid and a phenolic resin which is a resorcinol resin or a tannin resin, or a mixture thereof.

2. An adhesive system comprising a melaminic amino resin and a phenolic resin composition, characterised in that the phenolic resin composition comprises an acid and a phenolic resin, which is a resorcinol resin or a tannin resin, or a mixture thereof.

3. A stable phenolic resin composition for use in an melaminic amino resin based adhesive system, characterised in that it comprises an acid and a phenolic resin, which is a resorcinol resin or a tannin resin, or a mixture thereof.

4. A method according to claim 1, characterised in that the adhesive system is provided by separately applying the amino resin and the phenolic resin composition onto the wood based materials.

5. A method according to claim 1, characterised in that it comprises mixing the amino resin and the phenolic resin composition to form the adhesive system and then providing the adhesive system onto the wood based materials.

6. A method according to any of claims 1 or 4-5, or an adhesive system according to claim 2, characterised in that the amount melamine of total amount amino compounds used when making the amino resin is from about 30 to about 100 mole %.

7. A method according to any of claims 1 or 4-6, or an adhesive system according to claim 2 or 6, characterised in that the weight ratio amino resin to phenolic resin is from about 0.5 to about 2, based on dry matter.

8. A method according to any of claims 1 or 4-7, or an adhesive system according to any of claims 2 or 6-7, characterised in that the amino resin is a melamine-formaldehyde resin.

9. A method according to any of claims 1 or 4-7, or an adhesive system according to any of claims 2 or 6-7, characterised in that the amino resin is a melamine-urea-formaldehyde resin.

10. A method according to any of claims 1 or 4-9, or an adhesive system according to any of claims 2 or 6-9, characterised in that the pH of the adhesive system is from about 0 to about 4.

11. A method according to any of claims 1 or 4-10, or an adhesive system according to any of claims 2 or 6-10, or a phenolic resin composition according to claim 3,

characterised in that the phenolic resin is a phenol-resorcinol-formaldehyde resin.

12. A method according to any of claims 1 or 4-10, or an adhesive system according to any of claims 2 or 6-10, or a phenolic resin composition according to claim 3, characterised in that the phenolic resin is a tannin-formaldehyde resin or a tannin.

13. A method according to any of claims 1 or 4-12, or an adhesive system according to any of claims 2 or 6-12, or a phenolic resin composition according to any of claims 3 or 11-12, characterised in that the acid is aluminium chloride, aluminium nitrate or aluminium sulphate.

14. A method according to any of claims 1 or 4-12, or an adhesive system according to any of claims 2 or 6-12, or a phenolic resin composition according to any of claims 3 or 11-12, characterised in that the acid is selected from the group of mono-, di-, tri- or polycarboxylic acids and sulphonic acids.

15. A method according to claim 14, or an adhesive system according to claim 14, or a phenolic resin composition according to claim 14, characterised in that the acid is selected from the group of formic acid, acetic acid and pyrovic acid.

16. A method according to any of claims 1 or 4-12, or an adhesive system according to any of claims 2 or 6-12, or a phenolic resin composition according to any of claims 3 or 11-12, characterised in that the acid is selected from the group of hydrochloric acid, sulphuric acid, nitric acid, phosphoric acid, boric acid, sulphamic acid and ammonium salts.

17. A method according to any of claims 1 or 4-16, or an adhesive system according to any of claims 2 or 6-16, or a phenolic resin composition according to any of claims 3 or 11-16, characterised in that the content of phenolic resin in the hardener composition is from about 20 to about 60 weight %, based on dry matter.

18. A method according to any of claims 1 or 4-17, or an adhesive system according to any of claims 2 or 6-17, or a phenolic resin composition according to any of claims 4 or 11-17, characterised in that the content of the acid, including its salts, in the hardener composition is from about 2 to about 30 weight %.

19. A method according to any of claims 1 or 4-18, or an adhesive system according to any of claims 2 or 6-18, or a phenolic resin composition according to any of claims 4 or 11-18, characterised in that the pH of the phenolic resin composition is from about 0 to about 3.

20. A wood based product obtainable by the method according to any of claims 1 or 4-19.

21. A wood based product according to claim 20, characterised in that it is a laminated beam.

22. Use of an adhesive system according to any of claims 2 or 6-19 for making a wood based product.

23. A wood based product according to claim 22, characterised in that it is a laminated beam.

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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C09J C08G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 277 106 A (DYNOBEL AS) 3 August 1988 (1988-08-03) examples claims ---	1-23
A	DATABASE WPI Section Ch, Week 197723 Derwent Publications Ltd., London, GB; Class A21, AN 1977-40511Y XP002187543 & JP 52 051430 A (MITSUI TOATSU CHEM INC), 25 April 1977 (1977-04-25) abstract ---	1-23
X	EP 0 538 687 A (BASF AG) 28 April 1993 (1993-04-28) page 2, line 56 -page 3, line 10 -----	3

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

° Special categories of cited documents :

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"&" document member of the same patent family

Date of the actual completion of the international search 9 January 2003	Date of mailing of the international search report 16/01/2003
Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL – 2280 HV Rijswijk Tel. (+31–70) 340–2040, Tx. 31 651 epo nl, Fax: (+31–70) 340–3016	Authorized officer Schlicke, B

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
EP 0277106 A	03-08-1988	SE 460905 B	04-12-1989
		AT 74142 T	15-04-1992
		AU 595090 B2	22-03-1990
		AU 1060388 A	28-07-1988
		CA 1317062 A1	27-04-1993
		DE 3869438 D1	30-04-1992
		DK 27188 A	27-07-1988
		EP 0277106 A1	03-08-1988
		ES 2032337 T3	01-02-1993
		FI 880301 A ,B,	27-07-1988
		NO 880306 A ,B,	27-07-1988
		NZ 223267 A	28-05-1990
		SE 8700292 A	27-07-1988
		SE 8704793 A	27-07-1988
		US 4857609 A	15-08-1989
		US 4954581 A	04-09-1990
		AU 589309 B2	05-10-1989
		AU 1060888 A	28-07-1988
		CA 1315446 A1	30-03-1993
		DK 27288 A	27-07-1988
		EP 0277926 A2	10-08-1988
		FI 880302 A ,B,	27-07-1988
		NO 880307 A ,B,	27-07-1988
		NZ 223268 A	28-05-1990
		US 4831089 A	16-05-1989
JP 52051430 A	25-04-1977	JP 1072767 C	30-11-1981
		JP 55020512 B	03-06-1980
EP 0538687 A	28-04-1993	DE 4134776 A1	29-04-1993
		AT 149534 T	15-03-1997
		CZ 9203182 A3	12-05-1993
		DE 59208106 D1	10-04-1997
		DK 538687 T3	24-03-1997
		EP 0538687 A1	28-04-1993
		FI 924618 A	23-04-1993
		NO 924082 A	23-04-1993

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WO 01/70898 A1

(54) Title: ADHESIVE SYSTEM COMPRISING ETHERIFIED AMINO RESINS

(57) Abstract: The invention relates to an adhesive system comprising (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and (d) a polyvinyl alcohol and the use thereof for gluing wood based products. The invention also relates to a hardener composition for gluing systems of the amino resin type comprising, (b) a polymer prepared from one or more ethylenically unsaturated monomers, said polymer containing post-crosslinking groups, (c) a carboxylic acid and (d) a polyvinyl alcohol and the use thereof for formulating an adhesive system. The invention further relates to a method of application of the adhesive system or the hardener composition onto the surface to be glued.

ADHESIVE SYSTEM COMPRISING ETHERIFIED AMINO RESINS

The present invention relates to an adhesive system comprising an etherified amino resin, a polymer prepared from one or more ethylenically unsaturated monomers, a curing agent and a polyvinyl alcohol. The present invention also relates to the use of the adhesive system for gluing wood-based products and to a hardener composition for use in amino resin based gluing systems. Furthermore, the invention relates to a method of application of the adhesive system.

Adhesives systems suitable for use in wood-based constructions for outdoor use are generally based on formaldehyde resins, such as phenol-resorcinol-formaldehyde (PRF), phenol-formaldehyde (PF) and melamine-urea-formaldehyde (MUF). The major disadvantages of these adhesive systems are their long curing time at room temperature (~ 20 ^{0}C) and week bonding performance at temperatures below 20 ^{0}C. Typical pressing times for these systems are in the range of 5 to 24 hours at 20 ^{0}C. In addition to that, an after curing time, especially for melamine based resins, of several days is needed before the beams can be transported to the customers. These factors, of course, hamper seriously the productivity in, for example, laminated beam industries.

Furthermore, it is also known that amino resins, such as urea-formaldehyde (UF) resin, can be combined with dispersions of polymers of vinylic, acrylic, or butadiene-styrene type, in order to obtain improved bonding performance. Adhesives based merely on dispersions of polymers, like polyvinyl acetate, are not at all suitable for use in load bearing constructions. They do not meet the standards for, e.g., laminated beams. This is mainly due to their thermoplastic properties imparting creep in the construction and a poor durability.

EP 0 501 174 B1 discloses a hardening composition for urea-formaldehyde glues containing an aqueous emulsion of a polyvinyl acetate comprising post-crosslinking groups, an ammonium salt and urea. However, this hardening composition is not suitable for adhesive systems that have to be cured at room temperature, or at lower temperatures.

Thus, technical solutions are still sought for the need to find adhesive systems, which are fast curing even at room temperature or at lower temperatures and provide constructions with strong glue joints that meet the required standards for the end use products.

Accordingly, the present invention provides an adhesive system; a hardener composition suitable for use in amino resin based adhesive systems and a method of application of the adhesive system, by which the above-mentioned problems can be overcome.

The adhesive system according to the invention is defined in the appended claims. It comprises (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and (d) a polyvinyl alcohol.

The etherified amino resin used in the adhesive system according to the invention, as the resin component, can be any etherified amino resin, such as etherified urea-formaldehyde, etherified melamine-urea-formaldehyde, etherified melamine-formaldehyde, or etherified melamine-urea-phenol-formaldehyde resin. Preferred etherified amino resins are etherified melamine-urea-formaldehyde and etherified melamine-formaldehyde and most preferred is etherified melamine-formaldehyde.

The term "etherified amino resin", as used herein refers to an amino resin that has been modified by reaction with an alcohol, such as methanol, ethanol or butanol. The degree of etherification can be defined by ^{13}C NMR according to, e.g., the following formula:

$$\text{Degree of etherification} = \frac{RNHCH_2O\text{-}CH_3}{RNHCH_2O\text{-}CH_3 + CH_2OH} \times 100\ \%$$

Suitably the etherified amino resin has a degree of etherification of 4-95 % preferably 10-75 % and most preferably 30-60 %.

The resin component in the adhesive system may be comprised of a mixture of an etherified and a non-etherified amino resin. Suitable non-etherified amino resins include urea-formaldehyde, melamine-urea-formaldehyde, melamine-formaldehyde and melamine-urea-phenol-formaldehyde.

The amount of the etherified amino resin in the resin component is suitably 4 ≥ weight %, preferably ≥ 50.0 weight %, and most preferably ≥ 90.0 weight %, based on the solids of the resin component.

The total amount of the resin component in the adhesive system is suitably 10-90 weight %, preferably 40-85 weight % and most preferably 50-80 weight %, based on the solids of the adhesive system.

The polymer according to the invention is suitably a homopolymer or copolymer prepared from one or more ethylenically unsaturated monomers. Examples of suitable ethylenically unsaturated monomers are vinylic monomers, such as vinyl esters, e.g., vinyl acetate, vinyl propionate, vinyl butyrate and comonomers thereof with, e.g., ethylene; alkyl esters of acrylic and methacrylic acid such as methyl acrylate, methyl methacrylate, ethyl acrylate, n-butyl acrylate, etc.; butadiene-styrene and derivates thereof, such as carboxylated butadiene-styrene; substituted or unsubstituted mono- and dialkyl esters of alpha, beta-unsaturated dicarboxylic acids such as the substituted and unsubstituted mono- and dibutyl, mono- and diethyl maleate esters as well as the corresponding fumarates, itaconates and citronates; alpha beta-unsaturated carboxylic acids such as crotonic, acrylic and methacrylic acids and mixtures thereof. Polymers based on vinyl acetate are preferred. Preferably the polymer is prepared from at least 50 weight % vinyl acetate, based on the total weight of the monomers.

According to a preferred embodiment of the invention the polymer comprises post-crosslinking groups. The post-crosslinking groups can be incorporated into the polymer by copolymerising one or more ethylenically unsaturated monomers with at least one monomer comprising at least one post-crosslinking group. Suitable post-crosslinking groups include N-alkylol, N-alkoxymethyl, carboxylate and glycidyl groups.

By post-crosslinking monomer is herein meant a monomer having a first reactive functional group that renders the monomer copolymerisable with ethylenically unsaturated comonomer(s) and a second functional group that does not enter into the copolymerisation reaction during formation of the polymer, but provides a reactive site on the copolymer that may subsequently be reacted under, for example, acidic conditions, with another reactive site on the copolymer and/or the amino resin to crosslink the copolymer and/or the amino resin.

Suitable post-crosslinking monomers include, N-alkylol acrylamides, e.g., N-methylol acrylamide, N-ethanol acrylamide, N-propanol acrylamide, N-methylol methacrylamide, N-ethanol methacrylamide, N-propanol methacrylamide, N-methylol maleamide, N-methylol maleamic acid, N-methylol maleamic acid esters; the N-alkylol amides of the vinyl aromatic acids, such as N-methylol-p-vinylbenzamide and the like; also N-(alkoxymethyl) acrylates and methacrylates, where the alkyl group has from 1-8 carbon atoms, such as N-(methoxymethyl) acrylamide, N-(butoxymethyl) acrylamide, N-(methoxymethyl) methacrylamide, N-(butoxymethyl) allyl carbamate and N-(methoxymethyl) allyl carbamate, and mixtures of these monomers with allyl carbamate, acrylamide or methacrylamide; and also triallyl cyanurate. Preferably N-methylol acrylamide, or N-(butoxymethyl) acrylamide is used.

The polymer is suitably prepared from 0.1-10 weight % and preferably 0.2-6 weight % post-crosslinking monomer, based on the total weight of the monomers.

In a preferred embodiment the copolymer is based on vinyl acetate and N-methylol acrylamide.

The amount of the polymer in the adhesive system is suitably 5-60 weight %, preferably 10-50 weight % and most preferably 15-30 weight %, based on the solids of the adhesive system.

Mixtures of polymers containing post-crosslinking groups and polymers without post-crosslinking groups may also be used according to the invention. For example, the polymer may comprise both polyvinyl acetate without post-crosslinking groups and vinyl acetate based polymer containing post-crosslinking groups.

Preferably the polymer according to the invention is used in a form of an aqueous dispersion.

Suitable curing agents include organic acids that have a rapid curing rate even at room temperature (~ 20 °C) and below that. Preferred organic acids include carboxylic acids, such as formic and maleic acid, and most preferably formic acid. The curing agent can be present in the adhesive system in an amount of suitably 2-40 weight-%, preferably 5-20 weight-%, and most preferably 7-15 weight-%, based on the solids of the adhesive system.

Although polyvinyl alcohol is originally present in polyvinyl acetate (PVAc) dispersions in an amount of 4-6 weight-%, it has been found according to the present invention that an extra addition of PVA into the adhesive system, beyond that originally present in the PVAc dispersion, further improves the water resistance and glue joint strength of the finished products. Suitably the polyvinyl alcohol used has a degree of hydrolysis > 75 % and can be present in the adhesive system in an amount of 0.1-20 weight %, preferably 1-10 weight %, and most preferably 3-7 weight %, based on the solids of the adhesive system. Thus, the total amount of PVA in the adhesive system, including the PVA originally present in the PVAc dispersion, could be as high as 7-14 weight %, based on the solids of the adhesive system.

In a preferred embodiment of the invention the components b)-d) are mixed together into one component e), thus forming a hardener composition.

The adhesive system may also comprise fillers or other additives, such as glycol, suitable for the desired end use of the adhesive system.

The solids content of the adhesive system may be suitably 20-80 weight %, preferably 30-70 weight % and most preferably 45-65 weight %. The remaining part up to 100 weight % consist of water.

The term “adhesive system”, as used herein means a curing formulation of a resin and a hardener component and other suitable additives.

The claimed invention provides for adhesive systems that give improved pressing and after curing times, water resistance and glue joint strength even when cured at room temperature or below that. These adhesives systems are suitable for gluing wood-based products and preferably wood-based products for outdoor use, for example, laminated beams, finger joints and I-beams.

The hardener composition according to the present invention is defined in the appended claims. It comprises (b) a polymer prepared from one or more ethylenically unsaturated monomers, said polymer containing post-crosslinking groups, (c) a carboxylic acid and (d) a polyvinyl alcohol.

The polymer is a copolymer of one or more ethylenically unsaturated monomers and at least one monomer comprising at least one post-crosslinking group.

Suitable ethylenically unsaturated monomers and monomers comprising post-crosslinking groups for use in production of the polymer according to the invention are described herein above.

The amount of the polymer in the hardener composition is suitably 3-85 weight %, preferably 25-70 weight % and most preferably 45-65 weight %, based on the solids of the hardener composition. Preferably the polymer is used in a form of an aqueous dispersion.

The use of a carboxylic acid, which preferably is maleic or formic acid, provides a fast curing hardener composition even at room temperature, or below that.

Suitable amount of acid in the hardener composition is 2-50 weight %, preferred 10-50 weight % and most preferred 20-35 weight %, based on the solids of the hardener composition.

Preferably, a polyvinyl alcohol with a degree of hydrolysis of > 75 % is used. It is present in an amount of 0.1-40 weight %, preferably 4-30 weight % and most preferably 8-15 weight %, based on the solids of the hardener composition. The addition of extra polyvinyl alcohol, beyond that which originally may be present in, e.g., a PVAc based aqueous polymer dispersion, provides for further improved water resistance and adhesion properties of the adhesive systems where the claimed hardener composition is used.

If desired the hardener composition may also comprise fillers or other additives, such as glycol, suitable for the desired end use of the hardener composition.

The solids content of the hardener composition may be suitably 5-80 weight %, preferably 10-60 weight % and most preferably 30-50 weight %. The remaining part up to 100 weight % consist of water.

The term “solids” (of the adhesive system and the hardener composition) as used herein also includes the weight of the pure acid used as a curing agent, even in case the curing agent is a volatile acid, like formic acid.

The claimed hardener composition is suitable for use in formulating adhesive compositions based on amino resins, resulting in water and creep resistant adhesives systems, which provide for constructions with strong adhesive joints.

Although liquid adhesive systems, i.e., the resin and the hardener components are in liquid form, are preferred according to the invention, pulverous adhesive systems, i.e., the resin and/or the hardener components is/are in a pulverous form, may also be used if so desired.

The method of application of the adhesive system components according to the claimed invention is defined in the appended claims.

According to one preferred embodiment of this method each of the components of the adhesive system, a) – d) is applied separately onto the surface to be glued.

According to another preferred embodiment component a) is applied separately and components b)-d) are mixed before application and applied as one component e), the hardener composition, onto the surface to be glued.

In a further preferred embodiment all of the components a) –d) are mixed together at the moment of application and applied as one component onto the surface to be glued.

In the method of the present invention, the resin and the hardener components can be applied in any order in the form of strands or by means of spraying or by means of a curtain, more suitably, the resin and hardener are applied in the form of strands, or, alternatively, the hardener composition can be applied by means of spraying and the resin in the form of strands, wherein the hardener composition in either case, preferably is applied following the application of the resin. Preferably they are both applied in the form of strands.

Suitable amounts of the components to be applied can be in the range of 100-500 g/m^2 depending, inter alia, on the feeding rate.

Suitable devices and applications forms that can be used in the method according to the present invention for the application in the form of strands of both the resin and the hardener components, are disclosed in WO 99/67027, WO 99/67028 and WO 99/67341, which are hereby incorporated herein by reference.

The invention is further illustrated by means of the following non-limiting examples. Parts and percentages relate to parts by weight and percent by weight, respectively, unless otherwise stated.

Examples

In the examples according to the invention as component a) an etherified melamine-formaldehyde (EMF) resin with an etherification degree of 46 % and with a solids content of 68-72 % was used. In the comparison examples as component a) a non-etherified melamine-formaldehyde (MF) resin with a solids content of 63-68 % was used. Two different aqueous dispersions were used, one based on a polyvinyl acetate polymer containing post-crosslinking groups (PVAc-X) and one based on a conventional polyvinyl acetate polymer without post-crosslinking groups (PVAc).

Example 1: The composition of the hardener used is given below in table 1. The resin component used was etherified MF.

Table 1

Component	Weight % based on the total weight of the hardener composition
PVAc-X dispersion	22 %
Formic acid	11 %
Polyvinyl alcohol	5 %
Water	62 %

Example 2 (comparison): The same hardener composition as in example 1 was used and the resin component used was non-etherified MF.

Example 3: The composition of the hardener used is given below in table 2.

Table 2

Component	Weight % based on the total weight of the hardener composition
PVAc-X dispersion	27 %
Formic acid	11 %
Polyvinyl alcohol	0 %
Water	62 %

Example 4 (comparison): The same hardener composition as in example 3 was used and the resin component used was non-etherified MF.

Example 5: The composition of the hardener used is given below in table 3. The resin component used was etherified MF.

Table 3

Component	Weight % based on the total weight of the hardener composition
PVAc	27 %
Formic acid	11 %
Polyvinyl alcohol	0 %
Water	62 %

Example 6 (comparison): The same hardener composition as in example 5 was used and the resin component used was non-etherified MF.

Example 7: The composition of the hardener used is given below in table 4. The resin component used was etherified MF.

Table 4

Component	Weight % based on the total weight of the hardener composition
PVAc dispersion	22 %
Formic acid	11 %
Polyvinyl alcohol	5 %
Water	62 %

Example 8 (comparison): The same hardener composition as in example 7 was used and the resin component used was non-etherified MF.

The resin and the hardener components of the adhesive systems of the above described examples were separately applied, in a mixing ratio of 1:1, on 90 cm x 15,5 cm pieces of spruce and in an amount of 350 g/m^2. Thereafter laminates were formed from the pieces, which were pressed at a temperature of 20 ^{0}C, a pressure of 8 bar and a relative humidity of 60 % for 2 hours. After 36 hours of after curing time the laminates were tested for delamination according to the EN 391 B standard. The results are shown in table 5 below.

Table 5

Adhesive system according to	Delamination
Example 1	0.3 %
Example 2	0.61 %
Example 3	9.7 %
Example 4	14.1 %
Example 5	30.5 %
Example 6	82.1 %
Example 7	10.0 %
Example 8	28.2 %

Evidently the claimed adhesive systems provide for improved glue joints in relation to prior art adhesive systems.

CLAIMS

1. An adhesive system characterised in that it comprises, (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and (d) a polyvinyl alcohol.

2. A hardener composition for gluing systems of the amino resin type, characterised in that it comprises, (b) a polymer prepared from one or more ethylenically unsaturated monomers, said polymer containing post-crosslinking groups, (c) a carboxylic acid and (d) a polyvinyl alcohol.

3. An adhesive system according to claim 1, characterised in that the components a) – d) are present in the following indicated amounts in weight %, based on the solids of the adhesive system:

- a) from 40 to 85 weight %,
- b) from 10 to 50 weight %,
- c) from 5 to 20 weight %, and
- d) from 1 to 10 weight %.

4. An adhesive system according to claim 1 or 3, characterised in that the etherified amino resin has a degree of etherification of 10 to 75 %.

5. An adhesive system according to any of claims 1 or 3-4, characterised in that the etherified amino resin is an etherified melamine-formaldehyde or an etherified melamine-urea-formaldehyde resin.

6. An adhesive system according to any of claims 1 or 3-5 or a hardener composition according to claim 2, characterised in that the polymer is a homopolymer or copolymer prepared from one or more monomers selected from the group consisting of vinyl esters, alkyl esters of acrylic and methacrylic acid, mono- and dialkyl esters of alpha, beta-unsaturated dicarboxylic acids, alpha beta-unsaturated carboxylic acids, styrene- butadiene and derivates thereof, and mixtures thereof.

7. An adhesive system according to any of claims 1 or 3-6 or a hardener composition according to claim 2 or 6, characterised in that the polymer is a homopolymer or copolymer based on vinyl acetate.

8. An adhesive system according to any of claims 1 or 3-7, characterised in that the polymer comprises post-crosslinking groups.

9. An adhesive system according to claim 8 or a hardener composition according to any of claims 2 or 6-7, characterised in that the post-crosslinking groups are incorporated into the polymer by copolymerising one or more ethylenically unsaturated monomers with at least one monomer comprising at least one post-crosslinking group.

10. An adhesive system according to any of claims 1 or 3-9 or a hardener composition according to any of claims 2, 6-7 or 9, characterised in that the polymer is a copolymer of vinyl acetate and N-methylol-acrylamid.

11. An adhesive system according to any of claims 1 or 3-10, characterised in that the curing agent is a carboxylic acid.

12. An adhesive system according to claim 11 or a hardener composition according to any of claims 2, 6-7 or 9-10, characterised in that the carboxylic acid is formic acid or maleic acid.

13. A hardener composition according to any of claims 2, 6-7, 9-10 or 12, characterised in that the components are present in the following indicated amounts in weight %, based on the solids of the hardener composition:

- b) from 25 to 70 weight %
- c) 10 to 50 weight %
- d) from 4 to 30 weight %

14. Use of an adhesive system according to any of claims 1 or 3-12 for gluing wood-based products.

15. Use of a hardener composition according to claims 2, 6-7, 9-10 or 12-13, for formulating an amino resin based adhesive system.

16. A method of application of an adhesive system according to any one of claims 1 or 3-12 or a hardener composition according to any one of claims 2, 6-7, 9-10 or 12-13, characterised in that each of the components a) – d) is applied separately onto the surface to be glued.

17. A method of application of an adhesive system according to any one of claims 1 or 3-12 or a hardener composition according to any one of claims 2, 6-7, 9-10 or 12-13, characterised in that component a) is applied separately and components b)-d) are mixed before application and applied as one component e) onto the surface to be glued.

18. A method of application of an adhesive system according to any one of claims 1 or 3-12 or a hardener composition according to any one of claims 2, 6-7, 9-10 or 12-13, characterised in that all of the components a) –d) are mixed together at the moment of application and applied as one component onto the surface to be glued.

INTERNATIONAL SEARCH REPORT

Inter ·ional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 C09J161/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 7 C09J C09D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DE 21 58 604 A (UVA VERWALTUNGSANSTALT) 30 May 1973 (1973-05-30) example 7 page 5, line 29 ---	2,6,7,9, 10,14
X	US 4 940 481 A (MUELLER URS ET AL) 10 July 1990 (1990-07-10) claim 1 column 7, line 1 - line 15 column 4, line 44 - line 45 --- -/--	1,3-6,8, 9,11,12

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- "Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
X	PATENT ABSTRACTS OF JAPAN vol. 007, no. 225 (C-189), 6 October 1983 (1983-10-06) & JP 58 120661 A (SUMITOMO KAGAKU KOGYO KK), 18 July 1983 (1983-07-18) abstract	1,5,7-9
X	& DATABASE WPI Derwent Publications Ltd., London, GB; AN 1983-744611 abstract ---	1,5,7-9
X	EP 0 368 215 A (BASF AG) 16 May 1990 (1990-05-16) example 3 ---	1,5,8,9
X	EP 0 176 709 A (BASF AG) 9 April 1986 (1986-04-09) page 4, line 25 - line 42 -----	1,13

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2158604 A	30-05-1973	NONE	
US 4940481 A	10-07-1990	AT 29254 T	15-09-1987
		BR 8301032 A	22-11-1983
		DE 3373305 D	08-10-1987
		EP 0091398 A	12-10-1983
		IL 68021 A	31-03-1987
		JP 58164578 A	29-09-1983
		ZA 8301449 A	30-11-1983
JP 58120661 A	18-07-1983	JP 1048940 B	23-10-1989
		JP 1561795 C	31-05-1990
EP 0368215 A	16-05-1990	DE 3837965 A	17-05-1990
		AT 94192 T	15-09-1993
		DE 58905526 D	14-10-1993
		DK 556489 A	10-05-1990
		ES 2042937 T	16-12-1993
		FI 894394 A,B,	10-05-1990
		NO 176720 B	06-02-1995
		PT 92224 A	31-05-1990
		US 5330846 A	19-07-1994
EP 0176709 A	09-04-1986	DE 3430248 A	27-02-1986
		DE 3561154 D	21-01-1988

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(54) Title: PROCESS OF GLUING

(57) Abstract: A process for gluing laminated products with a curing amino adhesive, such as melamine urea formaldehyde (MUF) adhesive or urea formaldehyde (UF) adhesive, wherein a hardener comprising acid, acid salt and/or acid generating salt and a polymer dispersion or a mixture of different polymer dispersions and conventional additives, and the adhesive are applied separately at the parts to be glued, that the parts thereafter are joined and that the glue thereafter is cured under pressure, is described. Additionally, a use of a polymer dispersion or a mixture of different polymer dispersions in a hardener for use in a method for separate application of adhesive and hardener is disclosed.

PROCESS OF GLUING

Technical field

The present invention relates to gluing with urea-formaldehyde (UF)- and /or melamine-urea-formaldehyde (MUF) adhesive. More specifically the present invention relates to a method for separate application of UF or MUF adhesive and hardener on the substrate. Specifically the invention relates to the use of specific hardeners and a method for gluing laminated products such as parquet, edge bonding of surface layer for parquet, gluing of laminated wood, and the like in addition to gluing of foil on boards.

Background

The production of three layered parquet (sandwich parquet), usually comprising a surface layer of hardwood, a core layer of coniferous wood, e.g. spruce, and a balancing veneer layer, is an important field for industrial use of amino adhesives. In three layered parquet the fibre direction is arranged so that the fibres in the surface layer and balancing layer is running in substantially the same direction, whereas the fiber direction in the core layer is running substantially crosswise the direction of the two other layers.

The most commonly used gluing systems in the production of glued wooden products, are two component curable amino adhesives. Two main processes of gluing techniques are used for production of three-layered parquet and in many other lamination processes by means of amino adhesives:

a) a mix-in system, i.e. a system where the adhesive part and the hardener part is mixed before the mixture is applied on the substrate to be glued, and

b) a system for separate application, i.e. a system where the adhesive part and the hardener part are applied separately at the same or at different surfaces.

A well known problem in working with the mix-in system is that the pot life of the mixture, i.e. the useable time from the adhesive and the hardener are mixed until the mixture has to be applied, is shorter than required. There is always a contradiction between the required longest possible pot life and the request for glue to cure as fast as possible after the glue is applied to the substrate, so that the pressing is as short as possible. The problem with short pot life is most pronounced in using very rapid adhesive systems, for example to obtain very short press times for thereby to increase the speed of production. Cooling is often used to lengthen the pot life but for some fast curing glue systems the pot life still is too short for industrial use.

In using a glue mixture of adhesive and hardener the equipment for mixing and application has to be cleaned relatively often, resulting in unwanted stops in the production.

For extra fast adhesive systems the pot life are so short that it is impossible to mix the hardener and adhesive before application of the mixture. A method for separate application of hardener and adhesive has to be used for such fast systems. The above mentioned problems are mainly overcome by separate application.

A method for separate application of the hardener and the adhesive components is described in NO 152 449 to AB Casco. The hardener is applied first in the form of a low viscosity aqueous solution of hardener salt having a low content of solids at the substrate by means of a roller having a porous, absorbing surface. The adhesive is then applied at the substrate on top of the hardener solution by means of another application roller before the parts to be glued are laid against each other and are pressed together for the specified curing time.

The hardener according to NO 152 449 has a solids content of 15 to 25 % by weight, wherein the solids are acid or acid generating salts. By application on a substrate like wood the hardener is absorbed into the surface of the substrate. The absorption is desirable, as it prevents or reduces the problem caused by hardener that is taken up by the following application roller for the adhesive causing the adhesive to cure at the roller so that the production has to be stopped to clean the roller.

The fact that the hardener is absorbed by the substrate, however, prevents or reduces the adhesive to penetrate into the substrate, resulting in an inferior adhesion to the substrate and hence a weaker glue line is obtained. Additionally the use of this kind of hardener results in glue line having inferior gap filling properties and less flexibility than the use of mix-in glue systems. Separate application as described above, makes it possible to increase the speed of production and thus reduce the production costs compared with use of mix-in systems. However, separate application systems normally results in a glue line having inferior properties compared with mix-in glue systems.

An alternative method and means for separate application of adhesive and hardener is application of adhesive and hardener by means of nozzles, where one of the parts to be glued is passed under nozzles where the adhesive and hardener are applied at the surface of the substrate at the top of each other or side by side, se e.g. PCT/SE99/01083.

The best utilization of the catalytic properties of the hardener is obtained if the adhesive and hardener are kept separated until the materials to be glued, are joined. This may be achieved as describe above, by applying the hardener and adhesive in stripes besides each other or by applying the adhesive at one surface and the hardener at the other surface. In many instances it is impossible to apply the components so that they are kept separated until the materials are joined.

As an example is it often not possible in practice by veneering and other lamination of thin layers to transport these thin layers through an application device for application of adhesive and hardener. In some instances the application of hardener or adhesive on thin materials may result in visible bleed-through at the other side of the material. Additionally it is not suitable neither from an economical nor from a practical point of view to handle both the joining surfaces.

Thus, the use of mix-in systems and glue systems for separate application of adhesive and hardener have different advantages and disadvantages and the selection between the two systems is a compromise between technical, economical and quality related considerations.

NO 55 494 describes a hardener for manual separate application comprising a thickening agent, such as starch, to prevent the hardener from being adsorbed into the substrate. This hardener does not have sufficient adhesion to the substrate to avoid that the hardener will be pulled up by and fasten in the roller for application of adhesive in an automatic applicator.

It is thus a goal for the present invention to obtain a process of gluing where the most important advantages for both glue systems are obtained, i.e. that a short press time is obtained at the same time as a cured, flexible and waterproof glue line having good adhesion to the substrates, and where the mentioned shortcomings for the respective systems are eliminated or at least substantially reduced.

Summary of the invention

It is now surprisingly been found that addition of a polymer dispersion, to the hardener so that the hardener after application forms a film on the surface of the substrate, gives a substantial and unexpected reduction in curing time and an improvement in the characteristics of the glue line compared with the corresponding hardener without said dispersion. The preferred polymer dispersion is an emulsion adhesive.

According to a first aspect the present invention relates to a process for gluing products with a curing amino adhesive, such as melamine urea formaldehyde (MUF) adhesive or urea formaldehyde (UF) adhesive, wherein a hardener comprising acid, acid salt and/or acid generating salt and a polymer dispersion or a mixture of different polymer dispersions and conventional additives, and the adhesive are applied separately at the parts to be glued, that the parts thereafter are joined and that the glue thereafter is cured under pressure.

Preferably, energy is applied during the curing of the adhesive.

According to a preferred embodiment the adhesive and hardener are applied to the same surface.

It is preferred that the hardener is applied first to the surface and the adhesive thereafter is applied at the top of the hardener.

Alternatively, the adhesive is applied first to the surface and the hardener thereafter is applied at the top of the adhesive.

According to one embodiment, the adhesive and hardener are applied one at each surface to be glued.

The hardener is preferably applied in an amount in the range from 2 to 70 g/m^2, preferably 4 to 40 g/m^2.

According to a second aspect the present invention relates to a use of a hardener comprising acid, acidic salt and/or acid generating salt, a polymer dispersion or a mixture of different polymer dispersions and conventional additives in a method for gluing wooden materials by separate application of adhesive and hardener to a substrate, where the adhesive is a curing amino adhesive such as melamine-urea-formaldehyde (MUF) or urea-formaldehyde (UF) adhesive.

Preferably the polymer dispersion or mixture of polymer dispersions constitutes 20 to 80 % by weight, preferably 50 – 70 % by weight of the hardener.

It is preferred that the hardener has a pH of 0 to 4, preferably 0,5 to 3.

It is also preferred that the hardener includes in the range from 30 to 60 % by weight, preferably 35 to 50 % by weight solids.

According to a preferred embodiment, the polymer(s) in the polymer dispersion is (are) selected from vinyl adhesives, polyurethane and/or polyacrylate.

The polymer dispersion(s) is (are) in a preferred embodiment emulsion adhesive(s).

Preferably, the emulsion(s) comprises at least one cross-binding polymer.

The polymer(s) is (are) preferably polyvinylacetate, where preferably a part of the cross-binding polyvinylacetate.

The present invention is not limited to any special device for application of respectively the hardener or the adhesive. Thus the method is applicable to application with rollers, nozzles or application with a brush or the like.

It is known to use a dispersion of polyvinylacetate (PVAc) in hardeners for curing amino adhesives, see PCT/DK99/00159. The dispersion is said to favourable influence on the quality of the glue line. However, only mix-in systems are described in said application. The demands with regard to physical properties in a mix-in glue system and a glue system for separate application are very different.

Firstly, it is generally accepted in the field that a hardener for separate application, at least when the hardener and adhesive are to be applied by rollers, must have a relatively low content of solids and low surface tension so that it will be absorbed by the substrate to avoid that the hardener is pulled up by the roller for application of adhesive and create the above mentioned problems.

Secondly, there are contradictory considerations to be taken in developing a mix-in glue system and a glue system for separate application. As mentioned above, a mix-in system has to be a “slow” system or a system having a long pot life, whereas a system for separate application preferably is a “fast” system, curing rapidly after application of the adhesive and hardener.

Consequently it is surprising that a hardener containing in the range from 20 to 80 % by weight polymer dispersion, mainly corresponding to a hardener for a mix-in system, is applicable and has favourable properties in a method for separate application of adhesive and hardener.

Detailed description of the invention

The hardener according to the present invention comprises a liquid in which one or more acid(s), acid salt(s) and /or acid generating salt(s) as active component(s) are dissolved.

The selection of acid(s), acid salt(s) or acid generating salt(s) primarily depends on the desired characteristics for the hardener, such as how quickly it is desired that the curing takes place after the hardener and the adhesive are brought together.

Examples of preferred acids are phosphoric acid, sulfamic acid, maleic acid or citric acid.

Acid salts are in the context of the present invention salts that results in an acidic solution when they are dissolved in water. Examples of acid salts are aluminium nitrate, aluminium sulphate and aluminium chloride.

An acid generating salt is in the context of the present invention a salt that reacts with components in the adhesive to generate an acid. Preferred acid generating salts are ammonium salts, such as ammonium phosphate, ammonium sulphate and ammonium chloride.

The hardener may have a pH in the range from 0 to 4, preferably from 0.5 to 3.0. To obtain the preferred characteristics the harder has to include an acid and an acid salt, an acid and an acid generating salt, or an acid generating salt and an acid salt. The hardener may also comprise an acid in combination with both an acid generating salt and an acid salt. The hardener may also comprise more than one acid, more than one acid generating salt and/or more than one acid salt.

The amounts of the active ingredients in the hardener are combined so that the required pH and amount of acid are obtained, and are preferably primarily determined by the solubility of the salts and the required reactivity of the hardener.

The polymer that preferably is available in an aqueous solution in the hardener is preferably selected among vinyl adhesives, polyurethane and / or polyacrylate and may comprise one of the mentioned polymers or as a mixture of more than one of the mentioned polymers. The polymer dispersion may constitute 20 to 80 % by weight, preferably 50 to 70 % by weight of the hardener. Normally the content of solids in these dispersions as delivered, is in the range 40 to 60 % by weight. Thus, the polymer, or the solids, of the emulsion constitutes 8 to 48 % by weight, preferably 20 to 42 % by weight of the hardener.

It is also preferred that the dispersion or at least a part of the dispersion is functionalised.

The expression "functionalised" about polymers is in the present description and claims used in the meaning that the polymer comprises cross-binding groups.

Cross-binding groups may be introduced into vinyladhesives by introducing small amounts of reactive monomers such as N-methylolacrylamide or triallylcyanurate, to be polymerised with the vinyladhesive. Polyvinylacetate (PVAc), ethylenevinylacetate and polyvinylpropionate are examples on preferred vinyladhesives.

Preferred polymer dispersion may be emulsion adhesives, e.g. the emulsion adhesives described in US Patent No. 5.545.648. This polymer dispersion has a pH in the range 2 to 6 and comprises at least one homo- or co-polymer polyvinyl ester, and at least one polymer protective colloid.

Specially preferred as the copolymer are the copolymers that includes N-functional groups, such as (meth)arylamide, allylcarbamate, acrylonitrile, N-methylol(meth)acrylamide, N-methylolallylcarbamate, alcyl ethers and Mannich bases of N-methylol(meth)acrylamide and N-methylolallylcarbamate etc. It is preferred that the amount of these monomers is less than 15% of weight of the total amount of monomers.

To achieve the desired effect in that the hardener has improved adhesion to the substrate and to avoid that the hardener is taken up by the roller for application of the adhesive, it has surprisingly been found to be specially preferred to use polyvinylacetate as the polymer. It is specially preferred to combine two or more polyvinylacetate dispersions. It is most preferred to use two polyvinylacetate dispersions, of which one dispersion is non-modified and the other is modified to be cross binding. Preferably these dispersions are present in approximately the same amounts in the hardener.

The dispersions used in the hardener preferably have a molecular weight in the range from about 2000 to about 20000, have a viscosity in the range from 5000 to 40000 mPa*s, more preferably from about 10000 to about 25000 at 23 °C, and has a content of solids from 45 to 65 % by weight. It has been found to especially preferable that the used PVAc is crossbinding by polymerisation with small amounts reactive monomers as mentioned above.

The content of solids in the finished hardener is usually within the range 30 to 60 % by weight, more preferably 35 to 50 % by weight.

The hardener according to the present invention may additionally comprise additives that are traditionally added to hardeners, such as an antifoaming agent, surfactants, thickeners, colorants and formaldehyde scavengers.

Formaldehyde scavengers may be added to bind parts of the formaldehyde liberated during the curing process so that the emission of formaldehyde during the curing process and from the finished product is as low as possible. A suitable agent to bind formaldehyde is urea.

The skilled man in the art is aware of several antifoaming agents and surfactants that may be used in hardeners of this type. Suitable as thickeners are e.g. natural gum, guar gum and polyurethane thickeners. Examples on fillers are kaolin, talc and barium sulphate. Additionally colorants may be added to make it possible to control the application visually. Any colorant that does not adversely affect the catalytic properties of the hardener and that tolerates acidic pH may be used here.

Table 1. The hardener according to the present invention typically comprises, in % by weight:

Ingredient	**% by weight**
Polymer dispersion	20 – 80
Acid	0-30
Acid salt	0-20
Acid generating salt	0-20
Conventional additives	0-3
Formaldehyde scavenger	0-25
Filler	0-30
Water	to 100

Specific examples of useable hardeners are mentioned below.

The hardener may be applied by means of a roller and it has been demonstrated that a satisfactory even spread at a surface may be obtained both with a dense and hard roller, like a smooth roller of steel, or with a soft sponge roller with pores that absorb a part of the hardener. The regulation of the applied amount may be done in a conventional way, e.g. as described in NO 152.449. The hardener may also be applied by means of other suitable means for application of hardener, e.g. by means of nozzles.

The applied amount, measured in g/m^2, is of great importance as it is difficult to achieve an even spread using too low applied amount whereas too much applied hardener may result in problems for a subsequent application of the adhesive. The applied amount of hardener is preferably in the range 2 – 70 g/m^2, preferably 4 - 40 g/m^2.

The glue or adhesive in the present gluing system is of the amino adhesive type such as urea formaldehyde (UF) adhesive or melamine urea formaldehyde (MUF) adhesive. Preferably the UF and MUF adhesives have a content of solids of about 40 to 70 % by weight, a viscosity at about 600 to about 6000 mPa*s, preferably about 1500 mPa*s to

4500 mPa*s at 25 °C, and a content of free formaldehyde of less than 1%. Amino adhesives of this type may be produced by well known addition reactions of formaldehyde to the respective amino compound followed by a condensation reaction to produce the polymer. Said products are commercially available for example from Dynea AS under trademarks as Dynorit® L-103,Dynorit® L-108, Hiacoll GL7F, .Hiacoll H32H and Urex 3883.

The adhesive is normally applied after the application of the hardener and preferably immediately thereafter but it is also possible to apply the adhesive later. It is also possible to reverse the order of application. Conveniently a roller having a grooved surface is used for the application.

After application of hardener and adhesive the substrates to be glued are brought together. The assembled parts are then introduced into a press where the materials are exposed to pressure and are preferably supplied with energy as heat or high frequency electric currency, so called high frequency (HF), to accelerate the curing.

The required pressing time, i.e. the time from assembled parts are pressed together until the adhesive is sufficiently cured so that the pressure can be taken away and the glued materials may be handled, is dependent on the actual acid, acid salt and/or acid generating salt in the hardener, their concentration and the temperature, respectively the applied energy during the curing process. The preferred pressing time when applying HF energy during the curing of parquet is in the range 15 to 45 seconds, whereas it is about one second for foil bonding using roller presses. For cold pressing of laminated wood the pressing time is normally in the range of about 5 to 50 minutes.

A faster curing and a better glue line are obtained by using the hardener according to the present invention than by using a corresponding hardener not containing polymer dispersion. Without wishing to be bound by any particular theory, one possible explanation is that the polymer dispersion prevents the acid, the acid salt and/or the acid generating salt from being absorbed by the substrate. The polymer dispersion is known as an emulsion adhesive that will form a film at the surface of the substrate. The acid, the acid salt and/or the acid generating salt then remains in the film and thus remains more easily available for the adhesive when it is applied. It also seems that the polymer dispersion has sufficient adhesion to the substrate so that the hardener remains on the substrate and is not pulled up by the roller for application of adhesive so that the problems associated with that is avoided. A positive effect is that a good adhesion to both surfaces in the glue line is achieved.

Examples

The following tests are used in some of the examples below:

"Chisel test"

A knife was inserted into the glued joint of a laminate to split the laminate. The surface of the rupture was studied. For a high quality joint the rupture will be outside the glued joint, whereas a low quality joint will break in the glued joint.
A high quality joint was confirmed by a rupture outside the glued joint, as visualised by a rupture of the wood, confirming no rupture of the joint.

ANSI test

Laminated test samples having a dimension of 5 * 12,5 cm was tested according to American National Standard for Laminated Hardwood Flooring (ANSI/HPMA LHF-1987).

The test samples is exposed for three cycles of the following treatment: The samples are submerged in water at 25 °C for 4 hours and dried at 50 °C for 19 hours.

The requirement is that the total delamination for each test sample does not exceed 50 mm.

Preliminary comparison tests

A commonly used and generally accepted method for testing the expected curing time for a glue system under controlled conditions, is to measure the gel time, i.e. the time from the adhesive and hardener are mixed in a beaker or the like, to the mixture forms a gel.

For a practical measurement of gel time 50g adhesive was weighed into a beaker that was put into a water bath that was controlled at the desired temperature ± 0,5 °C. After stabilising the temperature, 1,0 g hardener was added with a disposable syringe and the mixture was agitated with a glass rod until a gel was formed, i.e. that the mixture became highly viscous and followed the glass rod. The time from addition of the hardener to the formation of the gel was measured with a stopwatch.

Dynorit® L-108 from Dynea ASA was used as adhesive in these preliminary tests.

Two different hardeners, a first hardener conventionally used for separate application in combination with Dynorit® L-108, and a second hardener according to the present invention, was used for the tests.

Table 2: The hardeners had the following compositions:

	Hardener according to the present invention	Conventional hardener for separat application
Aluminium chloride-6-hydrate	6 %	
Monoammonium phosphate	4 %	
Functionalised PVAc	60 %	
Antifoam additive	0,1 %	
Citric acid		8%
Aluminium sulphate		4%
Urea		0,3%
Surfactant	1,5%	0,05%
Water	to 100 %	to 100 %

Table 3: The measured gel times were as follows (in minutes (') and seconds ('')) :

	Hardener according to the present invention	Comments	Conventional hardener for separate application	Comments
20 °C	20'10''	Paste	12'30''	Paste
	24'30''	Gel	15'44''	Gel
50 °C	1'30'' / 1'35''		1'35'' / 1'35''	

This comparison test indicates that the two hardeners are approximately equally fast for this adhesive at 50 °C. The traditional hardener for mix-in glue systems was however somewhat faster at 20 °C than the hardener according to the present invention.

Example 1

A rectangular test specimen of 100 mm * 250 mm and a total thickness of 28 mm was produced in this test. The test specimen was produced according to the most common practice for production of sandwich parquet, where a 5 layered board having the surface layer in the middle, a core layer at each side of the surface layer and a backing veneer at each side of the assembled board is produced. This 5 layered is thereafter split by means of sawing in the middle of the surface layer to produce two boards of a 3 layered parquet.

The test specimen had a 8 mm thick surface layer in the middle. A core layer of spruce was placed at each of the surface layer side of the surface layer and a 2 mm thick backing veneer at each outer surface of the assembly.

The same hardener as used in the initial example mentioned above, was used in this test. The hardener was applied to the core layer by means of a plain steel cylinder roll in an amount of approx. 20 g/m^2.

Thereafter 150 g/m^2 of a urea formaldehyde adhesive was applied to the surfaces of the core layer by means of a hard rubber roller. The adhesive used was Dynorit® L-108 from Dynea ASA.

The beech surface layer was placed at the top of the coated surface and another core layer and a backing veneer were placed at the to of the surface layer to make up the described 5 layered structure. The assembled 5 layered structure was after a waiting time of about 2 minutes placed in a high frequency (HF) press wherein the parts were pressed together under simultaneous heating by means of high frequency electric current. The test specimen was added an effect of 2.2 kW by an anode current of 1 A in 15 seconds under a pressure of approx. 6 kp/cm^2. The test specimen was removed form the press and even after the short press time it was found that the curing progress was sufficiently advanced so that a very good adhesion between the core layer and the surface layer had been achieved.

After a waiting time of approx. one minute for final curing after the test specimen was removed from the press the strength of the joint line was exposed for a chisel test, where a knife was pressed into the joint line to split the surface layer from the core layer. The resulting fracture surface demonstrated 100 % fracture of the wood of the core layer, and no fracture of the glue line. This confirms that the quality of the glue line was good.

Comparison example

The test was carried out as outlined in example 1 with he following alterations:

- the hardener was substituted with the same standard hardener for separate application as described in the preliminary test,
- a press time of 25 seconds was necessary to obtain the sufficient curing and thereby adhesion to the substrate so that the test specimen could be removed from the press.

The chisel test as described above resulted in partly breach in the wood of the and partly in the glue when the core layer was split from the surface layer. In other words, the glue line obtained in this example after a press time of 25 seconds vs. 15 seconds in example 1, was weaker than the glue line of example 1.

This result was totally unexpected from the tests of the gel time in the preliminary test.

Example 2

Beech boards being 4 mm thick, 62 mm wide and 250 mm in length was edge glued. Hardener was applied at an edge of the board in an amount of 35 g/m^2 using a sponge.

Table 4: The hardener had the following composition:

Ingredient	**% by weight**
Aluminium nitrate	11
Ammonium chloride	6
Water	to 100
Functionalised PVAc dispersion	30
Non functionalised PVAc dispersion	28
Antifoaming agent	0,1
Total	100

Urea formaldehyde adhesive, Dynorit® L110L, from Dynea ASA, was applied at the adjacent side surface of another beech board with a brush in an amount of about 100 g/m^2.

Immediately after application of adhesive and hardener the side surfaces were pressed against each other and the boards was placed in a heating press with travers pressure. The temperature of the press plates was 105 °C. The glued beech boards were removed from the press after a press cycle time of 25 seconds. The glued joint already had a good handling strength. After conditioning at 20 °C/65% relative humidity (RH), the strength of the glued joint was tested by bending load perpendicular to the fibre orientation of the boards until the board broke. The fracture surface demonstrated 100 % fracture of the wood.

Example 3

A test was performed at a full-scale plant for parquet production. Normally a glue system comprising the adhesive Dynorit L-108 and a traditional hardener as mentioned in table 2, was used in the plant for production of 5 layered parquet for later splitting.

The HF-time in using the traditional glue system was 37 seconds. Reference tests were picked out from the normal production. The assembly time for all tests was 1-2 minutes.

Test parameters:

Materials: 5 layered sandwich parquet to be split, smoked beech surface layer

Applied adhesive: Dynorit L-108, approx. 155 g/m^2

Applied hardener: The inventive hardener according to table 2, approx. 22-27 g/m^2

Table 5 Results

Test item	Press time, sec.	Gluing results	Results, chisel test	ANSI test, delam. in mm			Surface temp., °C
				1	2	3	
1	22	Some loose backing veneer	Somewhat better than the reference	56*	67*	-	41-50
2	25	Some loose backing veneer	Somewhat better than the reference	0	0	88*	46-52
3	27	OK	Very good rupture of the wood in both glue lines	0	17	43*	44-58
4	32	OK	Very good rupture of the wood in both glue lines	0	0	0	45-58
5	37	OK	Very good rupture of the wood in both glue lines	0	0		55-59
Ref.	37	OK	Acceptable but not a deep rupture of the wood	5	0	0	75-80

* the glue line showed no indication of undercuring. The delamination was probably caused by the fact that the joint between two parquet blocks in the surface layer was to close to the edge of the test item (ca. 5mm). This will result in extraordinary tensions.

Example 4 – production of parquet

A test was performed at another a full-scale plant for parquet production. Normally a glue system comprising the adhesive Dynorit L-108 and a traditional hardener as mentioned in table 2, was used in the plant for production of 5 layered parquet for later splitting. Three presses were used, press 1 and 2 having a HF generator of 80 kW and press 3 having a HF generator of 120 kW.

Normally a glue system comprising Dynorit L-108 adhesive and a traditional hardener according to table 2 was used at the plant.

In a preliminary test, 19-20 g/m^2 hardener and 140 g/m^2 adhesive was applied. The materials was 6-layered parquet with oak surface layer having the configuration: backing veneer – core layer – 2 layers of 4 mm oak surface layers – core layer – backing veneer.

Table 6 Results

	Press 1	Press 2	Press 3
HF time (seconds)	33	34	22
Total time (seconds)	43	44	27
KJ	2965	2946	2939
Surface temperature of the stack when taken out of the press (°C)	65-67	67-74	64-72
Temperature in the glue line against the surface layer (drilling) (°C)	70-73		75-78
Result of gluing	Good	Good	Good

Tests with variation in press times were carried out in the same plant using the same presses at the same materials. The application of hardener was reduced to 14-15 g/m^2 and adhesive was applied at 130 – 140 g/m^2.

Table 7 Results

	Press 1			Press 2	Press 3	
Parallel	1	2	3	1	1	2
HF time (seconds)	28	23	18	23	20	17
Total time (seconds)	38	34	29	34	25	22
KJ	2386	1906	1531	1927	2726	2050
Surface temperature of the stack when taken out of the press (°C)	67-70	57-64	53-57	55-62	64-69	61-66
Temperature in the glue line against the surface layer (drilling) (°C)	61-68	62-65	49-53	59-62	55-57	
Result of gluing	Good	Good	Poor	Good	Good	

The maximum closed assembly time was found to be 5 minutes at a room temperature of 23 °C.

The tests showed that the HF time and he applied energy could be substantially reduced using the present method and the hardener comprising a polymer emulsion compared with the method normally used in the plant. The normal press times in the plant are 33 seconds in press 1 and 2, and 22 seconds in press 3. The HF time could be reduced from 33 to 22 seconds using press 1 or 2, and from 22 to 17 seconds in press 3, corresponding to a reduction in applied energy of about 1000 kJ. This reduction in press time and corresponding reduction in applied energy results in a reduction in the temperature in the materials of about 10-15 °C.

Example 5 – edge bonding of surface layer for parquet

The adhesive Dynorit L-108 and the present hardener according to table 2 were used for edge bonding of ash surface layer. The adhesive and the hardener were applied with rollers. Press times of 26 and 20 seconds at a press temperature of 105 °C were tested. The results were very good for both press times. During the normal day to day work a press time of 26 seconds are used in the actual plant.

Example 6 – effect of press time

5-layered parquet was produced in a full-scale plant using different press times with an oak surface layer. Due to the condition of the application roller for the hardener 35 g/m^2, i.e. more than 10 % by weight, was applied. 150 g/m^2 adhesive was applied in test 1, 2 and 3 and somewhat more adhesive was applied in test 4, 5 and 6.

The test items were divided in 5 pieces after pressing and the quality of the glue line was tested according to the chisel test after resting for one hour.

Table 8 Effect of different press times

	Test 1	Test 2	Test 3	Test 4	Test 5	Test 6
HF time, sec.	23	18	15	15	15	12
Post HF press time	9	14	17	17	9	20
Total press time	32	32	32	32	24	32
Surface temp., °C	66-70	60-62	55-60	55-57	Ca. 59	53-54
Glue line		Good	Good	Good	Good	Some poor points

Even after reducing the HF time from 23 seconds normally used in this press to 15 seconds and thus reducing the surface temperature 10 to 15 °C, the glue line had satisfactory quality.

It was also surprising that no problems with hardener being pulled up by the roller for application of the glue was observed even if the applied amount of hardener was higher than normal.

Example 7 – Parquet production

After the positive test of example 6, full-scale production was tested in the same plant using reduced HF times and different surface layers. The normal HF time in the plant using Dynorit L-108 adhesive and the traditional hardener according to table 2, was 23 seconds. The quality of the glue line was evaluated using the chisel test and an internal test scale from 0 to 10, 10 being the top score 10-15 minutes and 2 hours after gluing.

Table 9 Results

Surface layer	Ash	Ash	Beech	Beech	Oak
Amount of hardener Top roller, g/m^2, approx. Lower roller, g/m^2, approx.	 32 28	 32 28	 32 28	 32 28	 32 28
Amount of adhesive Top roller, g/m^2, approx. Lower roller, g/m^2, approx.	 165 140	 165 140	 165 140	 165 140	 165 140
HF time, seconds	17	15	17	15	17
Post HF press time, seconds	15	17	15	17	15
Total press time	32	32	32	32	32
Glue line temperature, °C [1)]	54-62		Ca. 60		56-65
Quality of glue line	8-10	7-8 [2)]		7-8	8-9

1) The correspondence between surface temperature and glue line temperature was good.

2) It was noted during the chisel test that the surface layer was somewhat looser compared with a HF time of 17 seconds.

The HF time was reduced from the normal 23 seconds to 17-15 seconds. This resulted in a reduction in surface temperature of about 15- 20 °C without any detrimental effect on the glue line.

The present invention is described with reference to examples for laminating of sandwich parquet and edge bonding of boards. The present invention is however applicable to other purposes such as gluing of single layer solid wood panels and the like and so-called foil bonding. Solid wood panels laminated boards are normally produced by edge bonding of boards typically having a thickness of 18 mm or 28 mm, as an example in a way corresponding to the above described edge bonding of thin beech boards.

Foilbonding is gluing of a foil to wood based boards, for example in the production of roofing sheets or boards for plate for children's furniture. In foil bonding the hardener is present in dry form at the reverse side of the foil. The adhesive is applied to the board before the foil and the boards are placed against each other and are pressed towards each other. Alternatively the adhesive and hardener are applied separately to the board in any order before the foil and plate are pressed towards each other. In foil bonding in a continuos process the press time often is as short as about one second.

Even if the present invention is described with reference to methods where heat is used to accelerate hardening, the present invention may also be used for cold pressing. The curing times will however be considerably longer for cold pressing than if heat is added and will typically be in the range from 5 to 50 minutes.

The present is, as described above, applicable for gluing of different materials and for different methods and equipment for separate application of glue and hardener, and in any sequence for application of the adhesive and hardener at the same surface or hardener at one surface and adhesive at the opposite surface of the surfaces to be glued joined.

Patent claims

1.

A process for gluing laminated products with a curing amino adhesive, such as melamine urea formaldehyde (MUF) adhesive or urea formaldehyde (UF) adhesive, wherein a hardener comprising acid, acid salt and/or acid generating salt and a polymer dispersion or a mixture of different polymer dispersions and conventional additives, and the adhesive are applied separately on the parts to be glued, that the parts thereafter are joined and that the glue thereafter is cured under pressure.

2.

The process according to claim 1, wherein energy is applied during the curing of the adhesive.

3.

The process according to claim 1 or 2, wherein the adhesive and hardener are applied to the same surface.

4.

The process according to claim 3, wherein the hardener is applied first to the surface and the adhesive thereafter is applied at the top of the hardener.

5.

The process according to claim 3, wherein the adhesive is applied first to the surface and the hardener thereafter is applied at the top of the adhesive.

6.

The process according to claim 1 or 2, wherein the adhesive and hardener are applied one at each surface to be glued.

7.

The process according to one of the previous claims, wherein the hardener is applied in an amount in the range from 2 to 70 g/m^2, preferably 4 to 40 g/m^2.

8.

A use of a hardener comprising acid, acidic salt and/or acid generating salt, a polymer dispersion or a mixture of different polymer dispersions and conventional additives in a process for gluing wooden materials by separate application of adhesive and hardener to a substrate, where the adhesive is a curing amino adhesive such as melamine-urea-formaldehyde (MUF) or urea-formaldehyde (UF) adhesive.

9.

The use according to claim 8, where the polymer dispersion or mixture of polymer dispersions constitutes 20 to 80 % by weight, preferably 50 – 70 % by weight of the hardener.

10.

The use according to claim 8 or 9, where hardener has a pH of 0 to 4, preferably 0,5 to 3.

11.

The use according to any of the claims 8 to 10, where hardener includes in the range from 30 to 60 % by weight, preferably 35 to 50 % by weight solids.

12.

The use according to one or more of the claims 8 to 11, wherein the polymer(s) in the polymer dispersion is (are) selected from vinyl adhesives, polyurethane and/or polyacrylate.

13.

The use according to one or more of the claims 8 to 12, wherein the polymer dispersion(s) is (are) emulsion adhesive(s).

14.

The use according to one or more of the claims 8 to 13, wherein the emulsion(s) comprises at least one cross-binding polymer.

15.

The use according to one or more of the claims 8 to 14, wherein the polymer(s) is (are) polyvinylacetate, where preferably a part of the cross-binding polyvinylacetate.

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(54) Adhesive system

(57) The invention relates to an adhesive system comprising (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and optionally (d) a polyvinyl alcohol and the use thereof for gluing wood based products. The invention also relates to a hardener composition for gluing systems of the amino resin type comprising, (b) a polymer prepared from one or more ethylenically unsaturated monomers, said polymer containing post-crosslinking groups, (c) a carboxylic acid and (d) a polyvinyl alcohol and the use thereof for formulating an adhesive system. The invention further relates to a method of application of the adhesive system or the hardener composition onto the surface to be glued.

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Description

[0001] The present invention relates to an adhesive system comprising an etherified amino resin, a polymer prepared from one or more ethylenically unsaturated monomers, a curing agent and optionally a polyvinyl alcohol. The present invention also relates to the use of the adhesive system for gluing wood-based products and to a hardener composition for use in amino resin based gluing systems. Furthermore, the invention relates to a method of application of the adhesive system.

[0002] Adhesives systems suitable for use in wood-based constructions for outdoor use are generally based on formaldehyde resins, such as phenol-resorcinol-formaldehyde (PRF), phenol-formaldehyde (PF) and melamine-urea-formaldehyde (MUF). The major disadvantages of these adhesive systems are their long curing time at room temperature (~ 20 °C) and week bonding performance at temperatures below 20 °C. Typical pressing times for these systems are in the range of 5 to 24 hours at 20 °C. In addition to that, an after curing time, especially for melamine based resins, of several days is needed before the beams can be transported to the customers. These factors, of course, hamper seriously the productivity in, for example, laminated beam industries.

[0003] Furthermore, it is also known that amino resins, such as urea-formaldehyde (UF) resin, can be combined with dispersions of polymers of vinylic, acrylic, or butadiene-styrene type, in order to obtain improved bonding performance. Adhesives based merely on dispersions of polymers, like polyvinyl acetate, are not at all suitable for use in load bearing constructions. They do not meet the standards for, e.g., laminated beams. This is mainly due to their thermoplastic properties imparting creep in the construction and a poor durability.

[0004] EP 0 501 174 B1 discloses a hardening composition for urea-formaldehyde glues containing an aqueous emulsion of a polyvinyl acetate comprising post-crosslinking groups, an ammonium salt and urea. However, this hardening composition is not suitable for adhesive systems that have to be cured at room temperature, or at lower temperatures.

[0005] Thus, technical solutions are still sought for the need to find adhesive systems, which are fast curing even at room temperature or at lower temperatures and provide constructions with strong glue joints that meet the required standards for the end use products.

[0006] Accordingly, the present invention provides an adhesive system; a hardener composition suitable for use in amino resin based adhesive systems and a method of application of the adhesive system, by which the above-mentioned problems can be overcome.

[0007] The adhesive system according to the invention is defined in the appended claims. It comprises (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and optionally (d) a polyvinyl alcohol.

[0008] The etherified amino resin used in the adhesive system according to the invention, as the resin component, can be any etherified amino resin, such as etherified urea-formaldehyde, etherified melamine-urea-formaldehyde, etherified melamine-formaldehyde, or etherified melamine-urea-phenol-formaldehyde resin. Preferred etherified amino resins are etherified melamine-urea-formaldehyde and etherified melamine-formaldehyde and most preferred is etherified melamine-formaldehyde.

[0009] The term "etherified amino resin", as used herein refers to an amino resin that has been modified by reaction with an alcohol, such as methanol, ethanol or butanol. The degree of etherification can be defined by ^{13}C NMR according to, e.g., the following formula:

$$\text{Degree of etherification} = \frac{RNHCH_2O\text{-}CH_3}{RNHCH_2O\text{-}CH_3+CH_2OH} \times 100\ \%$$

[0010] Suitably the etherified amino resin has a degree of etherification of 4-95 % preferably 10-75 % and most preferably 30-60 %.

[0011] The resin component in the adhesive system may be comprised of a mixture of an etherified and a non-etherified amino resin. Suitable non-etherified amino resins include urea-formaldehyde, melamine-urea-formaldehyde, melamine-formaldehyde and melamine-urea-phenol-formaldehyde.

[0012] The amount of the etherified amino resin in the resin component is suitably 4 ≥ weight %, preferably ≥ 50.0 weight %, and most preferably ≥ 90.0 weight %, based on the solids of the resin component.

[0013] The total amount of the resin component in the adhesive system is suitably 10-90 weight %, preferably 40-85 weight % and most preferably 50-80 weight %, based on the solids of the adhesive system.

[0014] The polymer according to the invention is suitably a homopolymer or copolymer prepared from one or more ethylenically unsaturated monomers. Examples of suitable ethylenically unsaturated monomers are vinylic monomers, such as vinyl esters, e.g., vinyl acetate, vinyl propionate, vinyl butyrate and comonomers thereof with, e.g., ethylene; alkyl esters of acrylic and methacrylic acid such as methyl acrylate, methyl methacrylate, ethyl acrylate, n-butyl acrylate, etc.; butadiene-styrene and derivates thereof, such as carboxylated butadiene-styrene; substituted or unsubstituted mono- and dialkyl esters of alpha, beta-unsaturated dicarboxylic acids such as the substituted and unsubstituted mono- and dibutyl, mono- and diethyl maleate esters as well as the corresponding fumarates, itaconates and citronates; alpha beta-unsaturated carboxylic acids such as crotonic, acrylic and methacrylic acids and mixtures thereof. Polymers based on vinyl acetate are preferred. Preferably the polymer is prepared from at least 50 weight % vinyl acetate, based on the total weight of the monomers.

[0015] According to a preferred embodiment of the invention the polymer comprises post-crosslinking groups. The post-crosslinking groups can be incorporated into the polymer by copolymerising one or more ethylenically unsaturated monomers with at least one monomer comprising at least one post-crosslinking group. Suitable post-crosslinking groups include N-alkylol, N-alkoxymethyl, carboxylate and glycidyl groups.

[0016] By post-crosslinking monomer is herein meant a monomer having a first reactive functional group that renders the monomer copolymerisable with ethylenically unsaturated comonomer(s) and a second functional group that does not enter into the copolymerisation reaction during formation of the polymer, but provides a reactive site on the copolymer that may subsequently be reacted under, for example, acidic conditions, with another reactive site on the copolymer and/or the amino resin to crosslink the copolymer and/or the amino resin.

[0017] Suitable post-crosslinking monomers include, N-alkylol acrylamides, e.g., N-methylol acrylamide, N-ethanol acrylamide, N-propanol acrylamide, N-methylol methacrylamide, N-ethanol methacrylamide, N-propanol methacrylamide, N-methylol maleamide, N-methylol maleamic acid, N-methylol maleamic acid esters; the N-alkylol amides of the vinyl aromatic acids, such as N-methylol-p-vinylbenzamide and the like; also N-(alkoxymethyl) acrylates and methacrylates, where the alkyl group has from 1-8 carbon atoms, such as N-(methoxymethyl) acrylamide, N-(butoxymethyl) acrylamide, N-(methoxymethyl) methacrylamide, N-(butoxymethyl) allyl carbamate and N-(methoxymethyl) allyl carbamate, and mixtures of these monomers with allyl carbamate, acrylamide or methacrylamide; and also triallyl cyanurate. Preferably N-methylol acrylamide, or N-(butoxymethyl) acrylamide is used.

[0018] The polymer is suitably prepared from 0.1-10 weight % and preferably 0.2-6 weight % post-crosslinking monomer, based on the total weight of the monomers.

[0019] In a preferred embodiment the copolymer is based on vinyl acetate and N-methylol acrylamide.

[0020] The amount of the polymer in the adhesive system is suitably 5-60 weight %, preferably 10-50 weight % and most preferably 15-30 weight %, based on the solids of the adhesive system.

[0021] Mixtures of polymers containing post-crosslinking groups and polymers without post-crosslinking groups may also be used according to the invention. For example, the polymer may comprise both polyvinyl acetate without post-crosslinking groups and vinyl acetate based polymer containing post-crosslinking groups.

[0022] Preferably the polymer according to the invention is used in a form of an aqueous dispersion.

[0023] Suitable curing agents include organic acids that have a rapid curing rate even at room temperature (~ 20 °C) and below that. Preferred organic acids include carboxylic acids, such as formic and maleic acid, and most preferably formic acid. The curing agent can be present in the adhesive system in an amount of suitably 2-40 weight-%, preferably 5-20 weight-%, and most preferably 7-15 weight-%, based on the solids of the adhesive system.

[0024] Preferably, the adhesive system also comprises polyvinyl alcohol (PVA). Although polyvinyl alcohol is originally present in polyvinyl acetate (PVAc) dispersions in an amount of 4-6 weight-%, it has been found according to the present invention that an extra addition of PVA into the adhesive system, beyond that originally present in the PVAc dispersion, further improves the water resistance and glue joint strength of the finished products. Suitably the polyvinyl alcohol used has a degree of hydrolysis > 75 % and can be present in the adhesive system in an amount of 0.1-20 weight %, preferably 1-10 weight %, and most preferably 3-7 weight %, based on the solids of the adhesive system. Thus, the total amount of PVA in the adhesive system, including the PVA originally present in the PVAc dispersion, could be as high as 7-14 weight %, based on the solids of the adhesive system.

[0025] In a preferred embodiment of the invention the components b)-d) are mixed together into one component e), thus forming a hardener composition.

[0026] The adhesive system may also comprise fillers or other additives, such as glycol, suitable for the desired end use of the adhesive system.

[0027] The solids content of the adhesive system may be suitably 20-80 weight %, preferably 30-70 weight % and most preferably 45-65 weight %. The remaining part up to 100 weight % consist of water.

[0028] The term "adhesive system", as used herein means a curing formulation of a resin and a hardener component and other suitable additives.

[0029] The claimed invention provides for adhesive systems that give improved pressing and after curing times, water resistance and glue joint strength even when cured at room temperature or below that. These adhesives systems are suitable for gluing wood-based products and preferably wood-based products for outdoor use, for example, laminated beams, finger joints and I-beams.

[0030] The hardener composition according to the present invention is defined in the appended claims. It comprises (b) a polymer prepared from one or more ethylenically unsaturated monomers, said polymer containing post-crosslinking groups, (c) a carboxylic acid and (d) a polyvinyl alcohol.

[0031] The polymer is a copolymer of one or more ethylenically unsaturated monomers and at least one monomer comprising at least one post-crosslinking group.

[0032] Suitable ethylenically unsaturated monomers and monomers comprising post-crosslinking groups for use in production of the polymer according to the invention are described herein above.

[0033] The amount of the polymer in the hardener composition is suitably 3-85 weight %, preferably 25-70 weight % and most preferably 45-65 weight %, based on the solids of the hardener composition. Preferably the polymer is used in a form of an aqueous dispersion.

[0034] The use of a carboxylic acid, which preferably is maleic or formic acid, provides a fast curing hardener composition even at room temperature, or below that.

[0035] Suitable amount of acid in the hardener composition is 2-50 weight %, preferred 10-50 weight % and most preferred 20-35 weight %, based on the solids of the hardener composition.

[0036] Preferably, a polyvinyl alcohol with a degree of hydrolysis of > 75 % is used. It is present in an amount of 0.1-40 weight %, preferably 4-30 weight % and most preferably 8-15 weight %, based on the solids of the hardener composition. The addition of extra polyvinyl alcohol, beyond that which originally may be present in, e.g., a PVAc based aqueous polymer dispersion, provides for further improved water resistance and adhesion properties of the adhesive systems where the claimed hardener composition is used.

[0037] If desired the hardener composition may also comprise fillers or other additives, such as glycol, suitable for the desired end use of the hardener composition.

[0038] The solids content of the hardener composition may be suitably 5-80 weight %, preferably 10-60 weight % and most preferably 30-50 weight %. The remaining part up to 100 weight % consist of water.

[0039] The term "solids" (of the adhesive system and the hardener composition) as used herein also includes the weight of the pure acid used as a curing agent, even in case the curing agent is a volatile acid, like formic acid.

[0040] The claimed hardener composition is suitable for use in formulating adhesive compositions based on amino resins, resulting in water and creep resistant adhesives systems, which provide for constructions with strong adhesive joints.

[0041] Although liquid adhesive systems, i.e. the resin and the hardener components are in liquid form, are preferred according to the invention, pulverous adhesive systems, i.e., the resin and/or the hardener components are in a pulverous form, may also be used if so desired.

[0042] The method of application of the adhesive system components according to the claimed invention is defined in the appended claims.

[0043] According to one preferred embodiment of this method each of the components of the adhesive system, a) - d) is applied separately onto the surface to be glued.

[0044] According to another preferred embodiment component a) is applied separately and components b)-d) are mixed before application and applied as one component e), the hardener composition, onto the surface to be glued.

[0045] In a further preferred embodiment all of the components a) -d) are mixed together at the moment of application and applied as one component onto the surface to be glued.

[0046] In the method of the present invention, the resin and the hardener components can be applied in any order in the form of strands or by means of spraying or by means of a curtain, more suitably, the resin and hardener are applied in the form of strands, or, alternatively, the hardener composition can be applied by means of spraying and the resin in the form of strands, wherein the hardener composition in either case, preferably is applied following the application of the resin. Preferably they are both applied in the form of strands.

[0047] Suitable amounts of the components to be applied can be in the range of 100-500 g/m^2 depending, inter alia, on the feeding rate.

[0048] Suitable devices and applications forms that can be used in the method according to the present invention for the application in the form of strands of both the resin and the hardener components, are disclosed in WO 99/67027, WO 99/67028 and WO 99/67341, which are hereby incorporated herein by reference.

[0049] The invention is further illustrated by means of the following non-limiting examples. Parts and percentages relate to parts by weight and percent by weight, respectively, unless otherwise stated.

Examples

[0050] In the examples according to the invention as component a) an etherified melamine-formaldehyde (EMF) resin with an etherification degree of 46 % and with a solids content of 68-72 % was used. In the comparison examples as component a) a non-etherified melamine-formaldehyde (MF) resin with a solids content of 63-68 % was used. Two different aqueous dispersions were used, one based on a polyvinyl acetate polymer containing post-crosslinking groups (PVAc-X) and one based on a conventional polyvinyl acetate polymer without post-crosslinking groups (PVAc).

[0051] Example 1: The composition of the hardener used is given below in table 1. The resin component used was etherified MF.

Table 1

Component	Weight % based on the total weight of the hardener composition
PVAc-X dispersion	22 %
Formic acid	11 %
Polyvinyl alcohol	5%
Water	62 %

[0052] Example 2 (comparison): The same hardener composition as in example 1 was used and the resin component used was non-etherified MF.

[0053] Example 3: The composition of the hardener used is given below in table 2.

Table 2

Component	Weight % based on the total weight of the hardener composition
PVAc-X dispersion	27 %
Formic acid	11 %
Polyvinyl alcohol	0 %
Water	62 %

[0054] Example 4 (comparison): The same hardener composition as in example 3 was used and the resin component used was non-etherified MF.

[0055] Example 5: The composition of the hardener used is given below in table 3. The resin component used was etherified MF.

Table 3

Component	Weight % based on the total weight of the hardener composition
PVAc	27 %
Formic acid	11 %
Polyvinyl alcohol	0 %
Water	62 %

[0056] Example 6 (comparison): The same hardener composition as in example 5 was used and the resin component used was non-etherified MF.

[0057] Example 7: The composition of the hardener used is given below in table 4. The resin component used was etherified MF.

Table 4

Component	Weight % based on the total weight of the hardener composition
PVAc dispersion	22 %
Formic acid	11 %
Polyvinyl alcohol	5 %
Water	62 %

[0058] Example 8 (comparison): The same hardener composition as in example 7 was used and the resin component used was non-etherified MF.

[0059] The resin and the hardener components of the adhesive systems of the above described examples were separately applied, in a mixing ratio of 1:1, on 90 cm x 15,5 cm pieces of spruce and in an amount of 350 g/m^2. Thereafter laminates were formed from the pieces, which were pressed at a temperature of 20 °C, a pressure of 8 bar and a relative humidity of 60 % for 2 hours. After 36 hours of after curing time the laminates were tested for delamination according to the EN 391 B standard. The results are shown in the table 5 below.

Table 5

Adhesive system according to	Delamination
Example 1	0.3 %
Example 2	0.61 %
Example 3	9.7 %
Example 4	14.1 %
Example 5	30.5 %
Example 6	82.1 %
Example 7	10.0 %
Example 8	28.2 %

Evidently the claimed adhesive systems provide for improved glue joints in relation to prior art adhesive systems.

Claims

1. An adhesive system **characterised in that** it comprises, (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and optionally (d) a polyvinyl alcohol.

2. A hardener composition for gluing systems of the amino resin type, **characterised in that** it comprises, (b) a polymer prepared from one or more ethylenically unsaturated monomers, said polymer containing post-crosslinking groups, (c) a carboxylic acid and (d) a polyvinyl alcohol.

3. An adhesive system according to claim 1, **characterised in that** the components a) - d) are present in the following indicated amounts in weight %, based on the solids of the adhesive system:

   - a) from 20 to 80 weight %,
   - b) from 10 to 50 weight %,
   - c) from 5 to 20 weight %, and
   - d) from 0 to 15 weight %.

4. An adhesive system according to claim 1 or 3, **characterised in that** the etherified amino resin has a degree of etherification of 10 to 75 %.

5. An adhesive system according to any of claims 1 or 3-4, **characterised in that** the etherified amino resin is an etherified melamine-formaldehyde or an etherified melamine-urea-formaldehyde resin.

6. An adhesive system according to any of claims 1 or 3-5 or a hardener composition according to claim 2, **characterised in that** the polymer is a homopolymer or copolymer prepared from one or more monomers selected from the group consisting of vinyl esters, alkyl esters of acrylic and methacrylic acid, mono- and dialkyl esters of alpha, beta-unsaturated dicarboxylic acids, alpha beta-unsaturated carboxylic acids, styrene- butadiene and derivates thereof, and mixtures thereof.

7. An adhesive system according to any of claims 1 or 3-6 or a hardener composition according to claim 2 or 6, **characterised in that** the polymer is a homopolymer or copolymer based on vinyl acetate.

8. An adhesive system according to any of claims 1 or 3-7, **characterised in that** the polymer comprises post-crosslinking groups.

9. An adhesive system according to claim 8 or a hardener composition according to any of claims 2 or 6-7, **characterised in that** the post-crosslinking groups are incorporated into the polymer by copolymerising one or more

ethylenically unsaturated monomers with at least one monomer comprising at least one post-crosslinking group.

10. An adhesive system according to any of claims 1 or 3-9 or a hardener composition according to any of claims 2, 6-7 or 9, **characterised in that** the polymer is a copolymer of vinyl acetate and N-methylol-acrylamid.

11. An adhesive system according to any of claims 1 or 3-10, **characterised in that** the curing agent is a carboxylic acid.

12. An adhesive system according to claim 11 or a hardener composition according to any of claims 2, 6-7 or 9-10, **characterised in that** the carboxylic acid is formic acid or maleic acid.

13. An adhesive system according to any of claims 1 or 3-12, **characterised in that** it comprises polyvinyl alcohol.

14. A hardener composition according to any of claims 2, 6-7, 9-10 or 12, **characterised in that** the components are present in the following indicated amounts in weight %, based on the solids of the hardener composition:

- b) from 25 to 70 weight %
- c) 10 to 60 weight %
- d) from 4 to 30 weight %

15. Use of an adhesive system according to any of claims 1 or 3-13 for gluing wood-based products.

16. Use of a hardener composition according to claims 2, 6-7, 9-10, 12 or 14, for formulating an amino resin based adhesive system.

17. A method of application of an adhesive system according to any one of claims 1 or 3-13 or a hardener composition according to any one of claims 2, 6-7, 9-10, 12 or 14, **characterised in that** each of the components a) - d) is applied separately onto the surface to be glued.

18. A method of application of an adhesive system according to any one of claims 1 or 3-13 or a hardener composition according to any one of claims 2, 6-7, 9-10, 12 or 14, **characterised in that** component a) is applied separately and components b)-d) are mixed before application and applied as one component e) onto the surface to be glued.

19. A method of application of an adhesive system according to any one of claims 1 or 3-13 or a hardener composition according to any one of claims 2, 6-7, 9-10, 12 or 14, **characterised in that** all of the components a) —d) are mixed together at the moment of application and applied as one component onto the surface to be glued.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 00 85 0048

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	DE 21 58 604 A (UVA VERWALTUNGSANSTALT) 30 May 1973 (1973-05-30) * example 7 * * page 5, line 29 * ---	2,6,7,9, 10,14	C09J161/28
X	US 4 940 481 A (MUELLER URS ET AL) 10 July 1990 (1990-07-10) * claim 1 * * column 7, line 1 - line 15 * * column 4, line 44 - line 45 * ---	1,3-6,8, 9,11,12	
X	PATENT ABSTRACTS OF JAPAN vol. 007, no. 225 (C-189), 6 October 1983 (1983-10-06) & JP 58 120661 A (SUMITOMO KAGAKU KOGYO KK), 18 July 1983 (1983-07-18) * abstract *	1,5,7-9	
X	& DATABASE WPI Derwent Publications Ltd., London, GB; AN 1983-744611 * abstract * ---	1,5,7-9	**TECHNICAL FIELDS SEARCHED (Int.Cl.7)**
X	EP 0 368 215 A (BASF AG) 16 May 1990 (1990-05-16) * example 3 * ---	1,5,8,9	C09J C09D
X	EP 0 176 709 A (BASF AG) 9 April 1986 (1986-04-09) * page 4, line 25 - line 42 * -----	1,13	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 May 2000	Paalman, R

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

EP 00 85 0048

25-05-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE 2158604 A	30-05-1973	NONE	
US 4940481 A	10-07-1990	AT 29254 T	15-09-1987
		BR 8301032 A	22-11-1983
		DE 3373305 D	08-10-1987
		EP 0091398 A	12-10-1983
		IL 68021 A	31-03-1987
		JP 58164578 A	29-09-1983
		ZA 8301449 A	30-11-1983
JP 58120661 A	18-07-1983	JP 1048940 B	23-10-1989
		JP 1561795 C	31-05-1990
EP 0368215 A	16-05-1990	DE 3837965 A	17-05-1990
		AT 94192 T	15-09-1993
		DE 58905526 D	14-10-1993
		DK 556489 A	10-05-1990
		ES 2042937 T	16-12-1993
		FI 894394 A,B,	10-05-1990
		NO 176720 B	06-02-1995
		PT 92224 A	31-05-1990
		US 5330846 A	19-07-1994
EP 0176709 A	09-04-1986	DE 3430248 A	27-02-1986
		DE 3561154 D	21-01-1988

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

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⑫
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(54) **Manufacture of particle board and a novel suitable bonding agent.**

(57) The invention concerns the manufacture of particle board having a very low formaldehyde emission, and a novel bonding agent. The essential feature is the use of a melamine-modified urea-formaldehyde adhesive with a ratio of formaldehyde to aminogroups of between 0.500 : 1 and 0.575 : 1, which contains melamine in an amount of between 1.0 and 10% by weight relative to resin solids. The boards which are so obtained have a very low formaldehyde emission (FESYP perforator value below 0.01%) and yet satisfactory physical properties.

EP 0 062 389 A1

MANUFACTURE OF PARTICLE BOARD AND A NOVEL SUITABLE BONDING AGENT

The invention relates to a method for the manufacture of particle board by hardening at elevated temperature and pressure of cellulose-containing material with an aminoplast resin as bonding agent, as wel as a bonding agent suitable in such a method.

It is known to manufacture chipboard with an ureaformaldehyde resin as bonding agent. If the molar ratio between formaldehyde and urea is high, e.g. above 1.3 or more, the board may release formaldehyde to the environment for a long time. Applicant has found that it is possible to produce board having a very low emission by using a urea-formaldehyde resin with a molar ratio of formaldehyde to urea of about 1.1, but that the mechanical properties of board produced by such a method are unsatisfactory, and especially so if the boards are stacked after pressing while still warm. An important disadvantage is also that, regardless of the stacking, the boards show considerable swelling when in contact with water. Applicant moreover found that the use of an greater than conventional amount of such bonding agent can overcome this disadvantage only to a limited extent.

The goal of the invention is a method for the manufacture of chipboard having a lower formaldehyde emission and satisfactory mechanical properties, and as well as a bonding agent suitable in such method.

According to the invention, particle board with an ureaformaldehyde resin as bonding agent is produced by effecting the conventional steps of providings a cellulose-containing particulate material with the bonding agent and next hardening said material at an elevated temperature and pressure to form a board, wherein the bonding agent is an urea-formaldehyde resin solution having a molar ratio of formaldehyde to mole equivalents of amino groups of between 0.500 to 1 and 0.575 to 1, and containing melamine in an amount of between 1.0 and 10 % by weight, relative to the total amount of resin solids.

By using the method according to the present invention with the novel bonding agent, it is possible to manufacture chipboard with a very low formaldehyde emission and yet satisfactory mechanical properties.

The cellulose-containing material may consist of wood chips or fibres, pine or hard wood, of conventional size. The bonding agent is applied to the material by a conventional method, such as spraying or tumbling. The amount applied may be between 6 and 15 % by weight, calculated as resin solids relative to the dry chips. The preferred amount is between 8 and 12 % by weight. The chip material may further be provided with conventional additives such as a moisture repellent, a curing catalyst, fungicides or other anti-microbial agents, defoamers and the likes. Such additives may be applied together with the resin solution or separately. The chip material is then formed into a chip mat and said mat is hardened to form chipboard at a temperature of between 140 °C and 220 °C and a pressure of up to 3.5 N/mm^2.

The bonding agent is a melamine-modified urea-formaldehyde resin solution with a molar ratio of formaldehyde to mole equivalents of amino groups of between 0.500 and 1 and 0.575 to 1. A bonding agent with a ratio of between 0.525 to 1 and 0.565 to 1, for instance about 0.55 to 1, is preferably used, as in this case an optimal combination of satisfactory mechanical strength and a low formaldehyde emission is obtained.

The ratio of formaldehyde to mole equivalents of aminogroups (F/NH_2 ratio) can easily be calculated by determining the total amount of moles of urea and melamine which have been used in the preparation of the bonding agent and calculating on the basis of these data the total amount of mole equivalents of aminogroups. The amount of formaldehyde used will also be known, so that the ratio F/NH_2 may be calculated.

One may also determine the molar ratio of formaldehyde to urea, i.e. disregarding the melamine. This molar ratio wil generally be not more than about 1.2 : 1 and will in particular be between about 1.1 : 1 and 1.18 : 1.

The melamine content of the bonding agent is very low and notably lower than that of conventional melamine-modified urea-formaldehyde resin solutions. The melamine content is between 1.0 and 10 % by weight calculated relative to the total amount of resin solids and preferably between 1.5 and 9 % by weight. At a low melamine content, e.g. about 2 % by weight, it may be advisable to use a rather large amount of resin relative to the chips while a fairly large melamine content, e.g. about 8 % by weight, should be used when it is intended to use a relatively small amount of bonding agent relative to the chips. A melamine content of between 3 and 6 % by weight may be preferred for general purposes.

Although for the purpose of various calculations the melamine is taken as the pure chemical compound, the melamine is actually present in the form of a melamine-formaldehyde condensate or as melamine-urea-formaldehyde cocondensate.

The solids content of the resin solution is of minor importance, as long as it is possible to bring the resin solution to a viscosity suitable for spraying. In most instances, the solids content is between 50 and 75 % by weight. The expression solids or resin solids as used herein means the dry residue remaining after evaporation of the resin solution for two hours at 120 °C.

The novel bonding agent may be prepared by several methods. One may for instance first effect a condensation of urea and formaldehyde and add melamine in the course of the condensation, preferably in the last stage. The condensation can be effected conventionally, for instance at a pH between 4 and 8 and a temperature between 75 °C and the boiling point of the solution. In many cases the formaldehyde to urea ratio is somewhat higher at the start, e.g. between 1.6 to 1 and 3.0 to 1, and the required additional amount of urea is added at a later stage of the condensation. A limited amount of the urea may even be added after completion of the condensation reaction. A melamine-formaldehyde resin may be added instead of pure melamine. It is also possible to separately prepare an urea-formaldehyde resin solution having a low formaldehyde to urea ratio and add a melamine-formaldehyde resin thereto after completion of the condensation. The melamine-formaldehyde resin may have a conventional molar ratio of formaldehyde to melamine, for instance between 1.5 to 1 and 1.8 to 1. It is also possible to take a conventional melamine-modified urea-formaldehyde resin and mix this, if required with heating, with a urea-formaldehyde resin having a much lower formaldehyde to urea ratio and optionally with an additional amount of urea.

The reactivity of an aminoplast adhesive is determined by adding a standard amount of catalyst (usually ammonium chloride) to the resin solution and measuring the gel time. The gel time is the time in which an aliquot of catalysed resin solution sealed in a glass tube suspended in an oil bath at 100 °C is converted to a gel. It is generally thought that in order to obtain a good curing and a strong bond, the adhesive should have a fairly short gel time, say between 40 and 90 seconds. The adhesive solutions according to the invention have long gel times, e.g. 100 to 250 seconds with conventional amounts of catalyst. Yet such catalysed adhesive solutions can be used to produce particle board with improved physical properties. It is to be noted that this phenomenon of the increase in gel time does not occur with the conventional resins in which 25 % by weight or more melamine has been incorporated. Applicant assumes that in the such latter case the curing of the melamine resin compent, which occurs at a pH close to neutral, overshadows the buffering action of melamine.

The invention will now be elucidated by means of the following expamples, without being restricted to the modes of realisation described therein.

Example 1

In a conventional resin kettle, 29 kg of formaldehyde (37 %) and 9.75 kg of urea were mixed and heated to the boiling point. Next the pH was brought to a value of 5 by addition of hydrochloric acid, which started the reaction. After a condensation period of 50 minutes at the boiling point, the reaction was quenched by adding enough of a base (sodium hydroxide) to bring the pH to a value of 8. Next, 1.24 kg of melamine were added to the reaction mixture while keeping the pH at a value of 8 and the temperature near the boiling point. The mixture was stirred for half and hour, after which 9.75 kg of urea were added and enough water was distilled off to bring the solids content to 65 % by weight. The solids content was determined by heating a sample for 2 hours at 120 °C and weighing the residue. Thereafter the reaction mixture was cooled. In this way 39.8 kg of resin solution, adhesive A, were obtained, with a melamine content of 4.77 % by weight and a F/NH_2 of 0.526.

This resin solution was used as the bonding agent in the preparation of chipboard of 17 mm thickness. To this end, chips were provided with the catalysed adhesive and strewn by hand to form a mat with thin outer layers and a thicker core layer. This mat was then pressed to form a board. The chips had previouly been provided with 0.4 % by wt. of a wax-based water-repelling agent (Mobilcer, RTM). The amount of bonding agent used was 11 % by weight of resin solids, relative to dry chips in all layers. The press temperature was 180 °C and the pressure 3.4 N/mm^2. The chipboard thus obtained had the following properties:

density	680 kg/m^3
tensile strength	0.64 N/mm^2
swelling (24 hrs. immersion at 20 °C)	14.3 %
water content	7.1 %
formaldehyde emission (FESYP perforator test).	0.008 % by wt

Example 2

Adhesives B and C were prepared by the method disclosed in example 1. For adhesive B the amount of melamine added in the second step was 0.80 kg and the amount of urea added in the last step was 9.96 kg. For adhesive C these amounts were respectively 1.62 kg of melamine and 9.56 kg of urea. As a comparison, adhesive Y was prepared by the same method, however without the addition of melamine and with addition of 10.34 kg of urea in the last step.

Adhesive B contains 3.08 % by wt of melamine and has a F/NH$_2$ ratio of 0.529. Adhesive C contains 6.15 % by wt of melamine and has a F/NH$_2$ ratio of 0.524. The comparative adhesive Y contains no melamine and has a F/NH$_2$ ratio of 0.534.

These adhesives were tested by using them to produce particle board by the process disclosed in example 1. However, for the thin outer layers chips containing 12 % by weight of adhesive, calculated on the dry (atro) chips, were used and for the core layer chips containing either 6 or 10 or 12 % by weight of adhesive were used. The physical poperties of the boards so obtained are pesented in table 1. All boards had a formaldehyde emission of less than 0.01 % (perforator test).

Table 1

adhesive type	adhesive, amount middle layer, wt %	density kg/m^3	tensile strenght N/mm^2	swelling, 24 hrs %
B	6	689	0.43	24.3
C	6	684	0.41	24.3
Y*	6	683	0.39	31.4
B	10	678	0.54	17.5
C	10	669	0.57	16.6
Y*	10	656	0.49	22.8
B	12	668	0.59	16.2
C	12	663	0.66	14.4
Y*	12	666	0.52	20.5
A	11 % all layers	680	0.64	14.3

*not according to the invention.

Example 3

An adhesive solution D was obtained by mixing a urea-formaldehyde resin solution with a small amount of melamine-formaldehyde resin solution. The resulting adhesive solution has a solids content of 56 % by weight, a F/NH_2 ratio of 0.550 and a melamine content of 5.33 % by weight based on resin solids.
By the same method an adhesive solution E was prepared at a solids content of 53 % by weight, a F/NH_2 ratio of 0.500 and a melamine content of 4.87 % by weight based on resin solids. As a comparison, an adhesive Z was prepared having a solids content of 56 % by weight, a F/NH_2 ratio of 0.550 which did contain only urea and no melamine.

These adhesives were used, after addition of a catalyst, to prepare particle board having a unitary structure and a thickness of 18 mm. The amount of adhesive was 9 % by weight (resin solids on dry chips) in all cases and the press conditions were 180 °C at 3.4 N/mm^2 for 17 seconds/mm of board thickness. In all cases, the gel time of the catalysed resin solution was determined. As a measure for the quality of the board, the tensile strength after 2 hours immersion in water of 20 °C was determined (V-20 strength according to DIn 68763). The relevant data are presented in table 2.

Tabel 2

adhesive	NH_4Cl	4 N . HCl	gel time	density	V-20	swelling
	wt % on resin solid		sec	kg/m^3	N/mm^2	% (24 hrs)
D	1.5	-	180	612	0.65	13.4
D	1.5	3.5	129	619	0.78	13.1
D	1.5	5.0	95	617	0.76	12.9
E	1.5	-	220	614	0.68	21.5
E	1.5	4	130	625	0.67	15.7
E	1.5	7.5	93	617	0.75	16.5
Z*	0.15	-	180	594	0.16	17.2
Z*	0.25	-	120	571	0.09	15.6
Z*	0.75	-	84	608	0.74	13.3

*not according to the invention.

CLAIMS

1. Method for the preparation of particle board with an urea-formaldehyde resin as bonding agent by providing a cellulose-containing particulate material with the bonding agent and next hardening said material at an elevated temperature and pressure to form a board, characterised in that the bonding agent is an urea-formaldehyde resin solution having a molar ratio of formaldehyde to mole equivalents of amino groups of between 0.500 to 1 and 0.575 to 1 and containing melamine in an amount of between 1.0 and 10 % by weight, relative to the total amount of resin solids.
2. Method according to claim 1, characterised in that the bonding agent has a melamine content of between 1.5 and 9 % by weight.
3. Method according to claims 1-2, characterised in that the bonding agent has a melamine content of between 3 and 6 % by weight.
4. Method according to claims 1-3, characterised in that the bonding agent has a molar ratio of formaldehyde to mole equivalent of amino groups 0.525 to 1 and 0.565 to 1.
5. Method according to claims 1-4, characterised in that the amount of bonding agent used is between 8 and 12 % by weight calculated as resin solids relative to dry chips.
6. Urea-formaldehyde resin solution, characterised in that the molar ratio of formaldehyde to mole equivalents of amino groups is between 0.500 to 1 and 0.575 to 1 and that the solution contains between 1 and 10 % by weight of melamine, relative to the total amount of resin solids.
7. Resin solution according to claim 6, characterised in that the melamine content is between 1.5 and 9 % by weight.
8. Resin solution according to claim 6-7, characterised in that the melamine content is between 3 and 6 % by weight.
9. Resin solution according to claims 6-8, characterised in that the molar ratio of formaldehyde to mole equivalents of aminogroups 0.525 to 1 and 0.565 to 1.
10. Particle board, obtained by the method of one or more of claims 1-5.

European Patent
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EUROPEAN SEARCH REPORT

0062389

Application number

EP 82 20 0427

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ^{3})
Y	GB-A- 627 167 (BRIT. RESIN PROD) *Claims; page 3, lines 22-26* ---	1-10	C 08 G 12/38 C 08 G 12/12 C 09 J 3/16 C 08 L 61/30 C 08 L 97/02
Y	US-A-2 772 197 (S.E.KOZDEMBA) *Claims* ---	1-10	
Y	EP-A-0 013 447 (METHANOL CHEMIE) *Claims* ---	1-10	
Y	EP-A-0 001 596 (BASF) *Claims; page 17; example 8* ---	1-10	
A	INTERNATIONAL POLYMER SCIENCE AND TECHNOLOGY, vol. 1, no. 5, 1974, pages 60-62; W.SZLEZYNGIER et al.: "Studies of reduction in the free formaldehyde content of urea-formaldehyde adhesive resins". *Pages 60-62* ---	1	TECHNICAL FIELDS SEARCHED (Int. Cl. ^{3}) C 08 G C 08 L C 09 J
A	CHEMICAL ABSTRACTS, vol. 83, 1975, page 63, no. 80460b, Columbus Ohio (USA); & JP - A - 75 35 230 (CHISSO CORP.) (03-04-1975) *Abstract* ---	1	
A	GB-A- 524 350 (BIP) *Claims* ---	1	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-07-1982	DERAEDT G.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

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EUROPEAN SEARCH REPORT

0062389

Application number

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Page 2

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
E	EP-A-0 037 878 (VEB LEUNA WERKE) *Claim; examples* -----	1-10	
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	08-07-1982	DERAEDT G.

CATEGORY OF CITED DOCUMENTS

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D : document cited in the application
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⑫ # EUROPEAN PATENT APPLICATION

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(54) **Manufacture of chip board and aminoplast adhesive used therefor.**

(57) The invention concerns the production of particle board with a very substantially lowered formaldehyde emission as well as suitable binding agents.

According to the invention the binding agent used in the production of the board is a combination of a polyisocyanate with a aminoplast resin containing 0.25 to 0.625 moles of formaldehyde per mole equivalent of aminogroups. The particle boards thus obtained possess satisfactory mechanical properties and a strongly reduced formaldehyde emission.

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METHANOL CHEMIE NEDERLAND V.o.F. and STAMICARBON B.V.

MANUFACTURE OF CHIPBOARD

The invention relates to a process for the manufacture of board material with a very substantially lowered formaldehyde emission, as well as of relevant suitable bonding agents.

It is known that board sheets can be manufactured by compression of cellulose-containing material with urea-formaldehyde or urea melamine formaldehyde resin as bonding agent. However, fibre board or chipboard produced in this manner emits minor quantities of formaldehyde into the air for a very long time. The formaldehyde emission from the board material can be reduced by lowering the quantity of formaldehyde relative to the amino compounds in the adhesive. It has been found, though, that this lowering of the formaldehyde content of the adhesive is subject to certain limits because it leads to reduced strength properties of the board. For weather-resistant board bonded with urea melamine formaldehyde, it has been found, for instance, that the weather resistance, measured as the V-100 tensile strength in accordance with DIN 68763, is in most cases still acceptable if the formaldehyde content, in terms of moles of formaldehyde per mole equivalent of amino group (F/NH_2) is at least 0.65 and preferably at least 0.75. If an adhesive with an F/NH_2 molar ratio lower than 0.65 is used, a strongly decreased V-100 value is found. An F/NH_2 molar ratio of 0.65 is regarded as a limit value, below which the V-100 value decreases very strongly and it is impossible in practice to obtain weather-resistant chipboard of good quality. For board which is used under dry conditions only, it is still possible to use adhesive with F/NH_2 molar ratios down to 0.625, although in this case, too, it is customary to use an F/NH_2 ratio of 0.7. It has also been proposed already to make weather-resistant chipboard which does not emit formaldehyde by using polyisocyanate as bonding agent in order to obtain weather-resistant chipboard. The drawbacks of this procedure are the high cost price of the bonding agent and the problems arising in the compression process. It has also been proposed already by way of compromise to use both an aminoplast resin and a polyisocyanate as bonding agents in order to obtain chipboard with the lowest possible cost of bonding agent. Since in that case the usual urea melamine formaldehyde resins are used, the problem of formaldehyde emission remains.

The object of the invention is the manufacture of chipboard or other shaped objects with very low formaldehyde emission and yet of sufficient strength.

According to the invention, chipboard or shaped objects is/are manufactured by hardening at elevated temperature and pressure of lignocellulose-containing chip material with a polyisocyanate and an aminoplast resin as bonding agents, the aminoplast resin, containing 0.25 to 0.625 mole of formaldehyde per mole equivalent of amino groups, being used in a quantity of between 3 and 14 % by wt. relative to the chip material, and the polyisocyanate in a quantity of between 0.5 and 3 % by wt. relative to the chip material.

It is found that the use of such a bonding agent combination permits of reducing the F/NH_2 molar ratio to a much lower level than is usual, without substantial deterioration of the mechanical properties of the final product.

With this method, board material can be obtained which combines a very low formaldehyde emission level with favourable strength properties. The price of the bonding agent system per m^3 of chipboard is about equal to or a little lower than the prices of the known bonding agents. The method is suitable for production of chipboard for dry applications as well as for production of 'limitedly weather resistant' chipboard. Essential to the invention is the use of an aminoplast resin on the basis of formaldehyde, urea and optionally melamine, in which the molar ratio between formaldehyde and amino groups (to be referred to hereinafter as the F/NH_2 ratio) is lower than that in the normally applied aminoplast adhesives.

For the manufacture of chipboard which is not exposed to moisture, a pure urea formaldehyde resin or urea melamine formaldehyde resin with a low melamine content may be used. The use of a small quantity of melamine has a favourable effect on the reactivity of the resin. The aminoplast adhesive for this application will generally have a melamine content of not more than 25% by wt. relative to the quantity of melamine plus urea. The F/NH_2 ratio in this mode of realization is preferably between 0.40 en 0.60, more in particular between 0.45 and 0.55. With increasing F/NH_2 ratio, the strength increases, but the formaldehyde emission too increases.

The method according to the invention is particularly suitable for the manufacture of chipboard which is resistant against the effects of moisture and weather influences. In this mode of realization, a urea melamine formaldehyde resin is used which contains between 25 and 70% by wt. of melamine relative to the quantity of melamine plus urea. The F/NH_2 ratio may be between 0.25 and 0.625. Favourable combinations of low formaldehyde emission and good strength are obtained notably with an F/NH_2 ratio of between 0.35 and 0.55, more in particular between 0.40 and 0.50. If the formaldehyde emission is not a very critical factor, a higher ratio may also be used, for instance 0.60. The melamine content is preferably between 40 and 60 % by wt.

In the mode of realization for manufacture of non-weather-resistant, the aminoplast resin may be used in a quantity of between 3 and 7% by wt. (solids weight) relative to the air-dry chips. In the mode of realization for manufacture of 'limitedly weather-resistant' board, the adhesive content is preferably between 7 and 12% by wt. A higher adhesive content is possible, but offers little advantage while adding to the costs of manufacture.

The aminoplast bonding agent may be prepared by adding an extra quantity of urea to a normally applied urea formaldehyde resin or urea melamine formaldehyde resin, with an F/NH_2 ratio of for instance between 0.8 and 0.65, or by mixing a melamine-formaldehyde resin with a urea (melamine) formaldehyde resin and adding urea to reach the desired F/NH_2 ratio. It is also possible to add the urea, which is required to obtain a low F/NH_2 ratio, entirely or in part to the chips separately, if desired in admixture with the polyisocyanate or with other additives. If so desired, the aminoplast resin may be modified through incorporation of a phenolic compound or through mixing with a phenol-formaldehyde resin. Other aminoplast-forming compounds in minor quantities may also be used, such as dicyandiamide, thiourea, biuret, guanidine, ammonia, etc. The effective F/NH_2 ratio is calculated on the basis of the quantity of amino groups applied in the form of aminoplast-forming compounds. Besides formaldehyde, minor quantities of another aldehyde such as acetaldehyde, isobutyraldehyde, crotonaldehyde or benzaldehyde may have been taken up in the resin.

The aminoplast adhesive solutions on the basis of formaldehyde, urea and, if desired, up to 70% by wt. of melamine relative to the quantity of melamine plus urea, in which between 0.25 and 0.625 mole of formaldehyde has been taken up, are novel products. Preferably, less than 0.55, in particular less than 0.50, mole of formaldehyde is used per mole equivalent of amino radicals. These adhesives are used for the manufacture of chipboard with a particularly low formaldehyde emission. The preparation of these adhesives, as indicated above, is very simple and does not require novel technology. It seems that these adhesives have a higher storage stability than similar adhesives with a higher formaldehyde content. For the preparation of weather-resistant odourless chipboard, adhesives with a melamine content of between 25 and 70% by wt. relative to melamine plus urea and an F/NH_2 ratio of between 0.40 and 0.50 are suitable in particular.

The normally used admixtures, such as moisture repellants, antifoaming agents, fungicides or other agents inhibiting microbial decomposition, may be added to the resin solution and/or the material to be bonded. The resin solution is diluted with water, if necessary, to such a degree that it becomes properly sprayable. The resin content is then mostly 50 to 60% by wt. A hardening catalyst is also added to the resin. Mostly this is a latent catalyst, ammonium chloride for instance, optionally in combination with ammonia or an acid.

The polyisocyanate used may be a compound with two or more isocyanate groups per molecule or a prepolymer derived therefrom, or a derivative with blocked isocyanate groups. Examples are toluene diisocyanate, hexamethylene diisocyanate, isophorone diisocyanate, etc. Advantageously, the low-priced diphenylmethane diisocyanate (MDI) or polyarylene polyisocyanate (PAPI) may be used in non-purified form. The polyisocyanate may be mixed with the aminoplast resin solution or may be applied separately as a liquid, dissolved or as an aqueous emulsion. The quantity of polyisocyanate used generally amounts to between 0.5 and 3.0% by wt. relative to the air-dry chipmaterials. Larger quantities are less desirable because they increase the cost price of the chipboard and may give rise to problems in the board compression process (sticking to press plates). In the vast majority of cases, good results are obtained with application of 0.5 to 2.0%

by wt. of polyisocyanate, in particular about 1.0% by wt.

Manufacture of the board material takes place in a known manner. The cellulose-containing material, such as wood chips and fibres, is sprayed with the resin solution and formed into a chip mat by spreading it on a suitable substrate. The polyisocyanate is applied either mixed with the resin solution or separately before, during or after application of the aminoplast resin. It seems that application of the isocyanate prior to application of the aminoplast resin offers the advantage of better control of the adhesive contents of the various chip fractions as the chip mat is spread out with the 'Wind-Sicht' equipment. The chip mat is then densified and hardenend in the usual manner at a temperature of between 150 and 200 °C and a maximum pressure of about 3.5 N/mm^2. For a more detailed description of current methods, reference may be made to, for instance, 'Technologie der Spanplatten' by H.J. Deppe and K. Ernst, Stuttgart 1964. The press plates may optionally be provided with a release agent. The process according to the invention may be used for the production of chipboard of homogeneous structure across the thickness as well as chipboard with a layered structure. In the latter case the layers may contain different amounts of binding agents. Although it is possible to use the aminoplast resin as the sole binding agent in the outer layers, it is clearly preferred to use the combination of aminoplast resin and polyisocyanate as binding agents for each layer.

The invention will now be elucidated by means of the following examples, without being restricted to the modes of realization described therein.

Example I

Preparation of a few adhesive resin solutions.

Various types of chipboard adhesive were prepared from the following components:

a) A melamine formaldehyde resin solution with a molar formaldehyde to melamine ratio of 1.6. This solution had been obtained by reacting melamine and formaldehyde in the usual manner at a pH higher than 9 and a temperature of 95 to 98 °C until a water dilutibility of about 1 : 1 (g of water per g of dissolved resin at 20 °C) had been reached, with subsequent evaporation under reduced pressure to a solids content of about 60% by wt.

b) A commercially available urea-formaldehyde resin solution with a molar formaldehyde to urea ratio of 1.25 (the commercial product

UF-6 SGA of Methanol Chemie Nederland).

c) Urea

By mixing of the components a), b) and c) in different proportions, the adhesive solutions A to E were obtained.

The mixing was readily effected by adding the components b) and c) to component c) during the cooling. These adhesive contained 38.6% by wt. of melamine, relative to melamine plus urea, with F/NH_2 ratios of between 0.325 and 0.50.

Example II

Manufacture of chipboard.

Using the adhesive solutions obtained as described in example I and diphenylmethane diisocyanate (MDI) as bonding agents, chip board sheets were manufactured, for the rest in the usual manner.

The adhesive solutions were mixed with an accelerator system (1.5% by wt. of ammonium chloride and, depending on the F/NH_2 ratio, up to 0.5% by wt. of 25% ammonia or up to 2% by wt. of 10 N hydrochloric acid, the percentages relating to the resin solids weight) and a moisture repellant (0.6% by wt. fo Mobilcer paraffin emulsion, relative to the dry chip weight), and diluted with water down to the viscosity required for spraying.

In the test series I the isocyanate was emulsified in the adhesive solution after which the mixture was sprayed on the chips. In test series II the adhesive solution and the isocyanate were sprayed separately.

The chip board was manufactured by spraying dust-free chips (70% wt. fir; 30% by wt. beech) with the bonding agents in a suitable mixer and then spreading them out into a mat which at a pressing temperature of 180 ^{o}C, with a maximum compression force of 3.4 N/mm^2 and a pressing time of about 4 minutes, was compressed into sheets of 40 x 40 cm, with a thickness of 16 mm and a density of about 700 kg/m^3.

The tensile strength of the sheets normal to the sheet surface after submersion for 2 hours in boiling water (V-100 tensile strength) was measured in accordance with DIN 68763.

The formaldehyde emission of the sheets was determined in accordance with the modified DSM/WKI (Roffael) method. In this method, a chip board sample is suspended over a saturated solution of common salt in a well sealed bottle at a temperature of 40 °C. The salt solution is renewed at subsequent intervals of 24,24,120,24 and 24 hours. The total quantity of formaldehyde absorbed into the salt solutions is determined and translated into mg of formaldehyde per m^2 of chip board. The composition of the adhesives, the quantity of bonding agent used, relative to the dry ('atro') chip material, and the strength and the formaldehyde emission of the chip board sheets have been summarized in table 1, series I and II.

Example III, comparative example

For the purpose of comparison, chip board was manufactured with bonding agents and bonding agent combinations which are outside the scope of the invention in test series III. The conditions and the results are shown in table 1, series III.

The table pertaining to the examples clearly shows that with the current types of UMF adhesive (resin types S and T), the use of a combination of isocyanate and UMF adhesive, instead of only UMF adhesive, results in a negligible difference in the V-100 tensile strength and only a minor decrease in the formaldehyde emission. With the novel types of UMF adhesive, with low F/NH_2 ratios, the strength of the chipboard sheets appears to be surprisingly high when a combination of isocyanate and UMF adhesive is used as a bonding agent instead of only the UMF adhesive.

Example IV

Some formaldehyde aminoplast resin adhesives with different melamine contents relative to the quantity of melamine plus urea, and with different F/NH_2 ratios were prepared in the manner described in example I. The resins were used as bonding agent for chip board, in combination with MDI, as described in example II, a mixture of the MDI and the aminoplast resin being sprayed on the chips. For the purpose of comparison, other chipboard sheets were manufactured in which only aminoplasts were used as bonding agent. The results are shown in table II.

Table I

test series		UMF type	F/NH_2 ratio	adhesive content wt.% rel. to chips UMF	MDI	tensile strength V-100 N/mm^2	F-emission (Roffael) mg/m^2x10^{-2}
I	6	A	0.50	12	0.5	0.2	4
	7	A	0.50	10	1	0.25	4
	15	C	0.40	12	0.5	0.1	1
	16	C	0.40	10	1	0.2	1
	17	C	0.40	8	2	0.2	1
	22	E	0.325	10	1	0.15	unknown
II	8	A	0.50	12	0.5	0.25	4
	9	A	0.50	10	1	0.3	4
	11	B	0.45	12	0.5	0.2	2
	12	B	0.45	10	1	0.3	2
	13	B	0.45	8	2	0.25	2
	18	C	0.40	12	0.5	0.1	1
	19	C	0.40	10	1	0.25	1
	21	D	0.35	10	1	0.2	0.5
III*	1	S**	0.80	14	-	0.35	50
	2	S	0.80	10	1	0.35	40
	3	T**	0.65	14	-	0.3	17
	4	T	0.65	10	1	0.3	15
	5	A	0.50	14	-	0.1	4
	10	B	0.45	14	-	0.05	2
	14	C	0.40	14	-	0	1
	20	D	0.35	14	-	0	0.5

*) comparative test series

**) commercially available types of UMF adhesive of Methanol Chemie Nederland

Table II

test-series		UMF type	content of M, %	F/NH_2 ratio	adhesive content wt.% rel. to chips		tensile strength V-100 N/mm^2
					UMF	MDI	
IV	23	F	45	0.45	10	1	0.28
	24	G	45	0.40	10	1	0.25
	25	H	45	0.325	10	1	0.20
	26	1	45	0.275	10	1	0.15
	27	K	50	0.45	9	1	0.30
	28	L	60	0.45	8	1	0.27
IV*	29	F	45	0.45	14	-	0.13
	30	G	45	0.40	14	-	0.10
	31	H	45	0.325	14	-	0
	32	I	45	0.275	14	-	0
	33	K	50	0.45	13	-	0.15

*) comparative test series, not according to the invention

Example V

Urea-formaldehyde resin adhesives M and N were prepared by mixing components b) and c), described in example I, in different ratios. These adhesives were used in combination with MDI as binding agents in the production of particle board as described in example II. A mixture of MDI and the resin solution was sprayed on the dust-free chips (30% by wt. fir, 70% by wt. beech). The particle board thus obtained is of the type suitable for dry indoors applications. The mechanical properties were determined according to DIN 68763. The results are set out in table III.

For comparison, boards were produced by the same method but now with the aminoplast resin as the sole binding agent. Results of these experiments are also set out in table III.

Table III

series	test	UF type	F/NH_2 ratio	adhesive content % by wt on chips		tensile strength V-20 N/mm^2	flexural strength N/mm^2
				UF	MDI		
V	34	M	0.55	4	1	0.6	19
	35	N	0.45	4	1	0.4	17
	36	N	0.45	6.5	0.5	0.5	18
	37	N	0.45	7	1	0.6	18
V*	40	V**	0.625	9	-	0.6	19
	38	M	0.55	9	-	0.5	16
	39	N	0.45	9	-	0.1	9

*) comparative test series, not according to the invention

**) commercially available UF-resin adhesive (UF-6 SGA)

CLAIMS

1. Method for the manufacture of chip board or shaped objects by hardening at elevated temperature and pressure of lignocellulose-containing chips material with a polyisocyanate and an aminoplast resin as bonding agents, characterized in that the aminoplast resin, prepared with application of 0.25 to 0.625 mole of formaldehyde per mole equivalent of amino groups, is used in a quantity of between 3 and 14% by wt. relative to the chip material, and the polyisocyanate in a quantity of between 0.5 and 3.0% by wt. relative to the chip material.
2. Method according to claim 1, characterized in that use is made of an aminoplast resin on the basis of formaldehyde, urea and optionally melamine, in a quantity of 0 to 25% by wt. relative to the quantity of melamine plus urea, with an F/NH_2 molar ratio of between 0.40 and 0.60.
3. Method according to claim 2, characterized in that an aminoplast resin is used with an F/NH_2 molar ratio of between 0.45 and 0.55.
4. Method according to claim 1, characterized in that for the manufacture of weather-resistant chip board use is made of an aminoplast resin on the basis of formaldehyde, urea and melamine, containing 25-70% by wt. of melamine relative to melamine plus urea, and having an F/NH_2 molar ratio of between 0.25 and 0.625, in a quantity of between 7 and 12% by wt. relative to the chip material.
5. Method according to claim 4, characterized in that use is made of an aminoplast resin with an F/NH_2 molar ratio of between 0.35 and 0.55.
6. Method according to claim 4-5, characterized in that an aminoplast resin is used, which contains between 40 and 60% by weight of melamine, relative to melamine plus urea.
7. Method according to claims 1-6, characterized in that the polyisocyanate is used in a quantity of between 0.5 and 2.0% by wt. relative to the chip material.
8. Chip board manufactured by application of the method according to any one or more of the claims 1-7.
9. Aminoplast adhesive solution on the basis of formaldehyde, urea and 0 to 70% by wt. of melamine, relative to the quantity of melamine plus urea, characterized in that the adhesive contains between 0.25 and 0.625 mole of formaldehyde per mole equivalent of amino groups.

10. Aminoplast adhesive solution according to claim 9, characterized in that per mole equivalent of amino group between 0.40 and 0.50 mole of formaldehyde has been taken up, and in that the melamine content is between 40 and 60% by wt., relative to the quantity of melamine plus urea.

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(54) Manufacture of chipboard.

(57) Process of manufacturing sheets by providing particulate cellulose-containing material with a catalyst-containing, possibly melamine-modified urea-formaldehyde resin as a binder and pressing it into a sheet at elevated temperature and increased pressure, in which the binder has a molar formaldehyde-to-amino-groups ratio (F/NH_2) between 0.25 and 0.625 and the catalyst comprises a mixture of a latent catalyst and a strong acid in an effective amount.

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MANUFACTURE OF CHIPBOARD

The invention relates to the manufacture of sheets by compressing particulate cellulose-containing material into a sheet at elevated temperature and increased pressure using an aminoplast resin as binder, in particular to the manufacture of chipboard from wood chips.

It is known that the formaldehyde emission of the sheets can be reduced by using as binder a urea-formaldehyde resin or melamine-urea-formaldehyde resin with a low molar ratio between the formaldehyde and the amino groups present.

In order to increase the strength of the sheets a melamine-containing resin is used and/or a polyisocyanate is added as additional binder. In the latter case, when larger quantities of polyisocyanate are used there is the danger of the sheets adhering to the pressing plates. For smooth operation under all conditions, the polyisocyanate content should preferably be less than 2 per cent by weight, referred to dry chips. At relatively long pressing times, this is well possible.

Applicant has found, however, that with a faster-setting system, for example one suitable for pressing times of 7-10 s/mm, at a pressing temperature of 180 °C, the polyisocyanate content should be at least 1 per cent by weight and preferably 2 per cent by weight or more in order to obtain sheets which have a good strength, even under humid conditions.

The aim of the invention is to provide a binder system with which a sheet of sufficient strength and a low formaldehyde emission level can be made at a short pressing time, which system contains little or no polyisocyanate.

According to the invention a sheet is obtained by providing particulate cellulose-containing material with a catalyst-containing, optionally melamine-modified urea-formaldehyde resin,compressing it into a sheet at elevated temperature and increased pressure, the molar ratio of formaldehyde to amino groups in the resin being between 0.25 and 0.625 and the catalyst comprising a mixture of a latent catalyst and a strong acid in an effective amount.

With the process of the invention, the aim set can indeed be achieved. When a mixture of a polyisocyanate and a urea-melamine-formaldehyde resin is used as a binder, the co-use of a strong acid as a catalyst is found to enable a reduction of the pressing time to less than 8 s/mm, yet less than 2 per cent by weight, in most cases even less than 1 per cent by weight of polyisocyanate is required to achieve the desired strength.

In systems in which only a urea-formaldehyde resin, optionally modified with melamine, is used as the binder, the addition of a strong acid gives, besides the higher reactivity, a sheet with better swell properties and equivalent or better strength. In all cases, the level of formaldehyde emission remains the same or even decreases.

According to one particular mode of realisation, as a binder a combination of a polyisocyanate and a, preferably melamine-modified, urea-formaldehyde resin is used.

The molar ratio between formaldehyde and amino groups ('F/NH_2') is here between 0.25 and 0.625, preferably between 0.4 and 0.55. The melamine content may be up to 70 per cent by weight, relative to the total quantity of urea and melamine, and is preferably between 25 and 70 per cent by weight, more in particular between 40 and 60 per cent by weight. Similar systems have been described in European Patent Application No. EP-0,025,245 A. As a catalyst, a combination of a known latent catalyst such as ammonium chloride or ammonium sulphate and a strong acid is used. The quantity of latent catalyst is generally between 1 and 3 per cent by weight, relative to the resin solids. The quantity of strong acid is generally at least 20 milliequivalents of acid per 100 grams of resin. Preferably, between 20 and 80 meqs are used per 100 grams of resin, more in particular between 35 and 65 meqs per 100 grams of resin. The quantity of strong acid is generally such that the pressing time, at a pressing temperature of 180 °C, can be reduced to 10 seconds/mm thickness or less, preferably to 8 seconds or less, without too great a reduction in 'pot-life' of the catalysed system.

The amount of resin applied to the chips is generally 6-14 per cent by weight of resin solids relative to the dry chips, and preferably 8-12 per cent by weight. The quantity of polyisocyanate is preferably less than 2 per cent by weight relative to dry chips, notably between 0.1 and 2 per cent by weight, and more in particular between 0.3 and 1.5 per cent by weight.

As acid, generally organic or inorganic acids are used with a strength equal to or greater than that of formic acid.

The expression strong acid as used herein also comprises acid salts, and acid reacting salts, i.e. salts of a strong acid and a weak base. Examples are formic acid, trichloracetic acid, oxalic acid, citric acid, toluene sulphonic acid, hydrochloric acid, sulphuric acid and phosphoric acid. Where possible, formic acid is used, in particular with resins containing much melamine.

Further, in a large number of cases also sulphuric acid can be used, especially with resins containing little melamine.

The main object of the above-described mode of realisation is the manufacture of weather-resistant sheets.

Another mode of realisation is mainly for application in the manufacture of sheets for use in an environment of low humidity. Here, a resin is used which contains between 1 and 10 per cent by weight of melamine and has a F/NH_2 ratio of between 0.425 and 0.625. Preferably, the melamine content is between 2 and 8 per cent by weight and the F/NH_2 ratio between 0.45 and 0.55.

The adhesive content may be between 6 and 15 per cent by weight relative to the dry chips, and is preferably between 8 and 12 per cent by weight. As strong acid, sulphuric acid is preferably used here. The amount of latent catalyst is generally between 1.0 and 3 per cent by weight referred to the resin solids. The amount of acid is generally between 10 and 70 meqs per 100 grams of resin. The higher the melamine content, the greater the amount of strong acid may be.

Besides the modes of realisation described, also other binders may be used, for example a urea-melamine-formaldehyde resin with a high melamine content catalysed with latent catalyst and a strong acid.

For the sake of the stability of the resin solution, normally first the amount of latent catalyst will be increased and only then will it be determined, by manual tests, what the amount of strong acid is which gives a favourable balance of reactivity, pot-life of the adhesive and strength of the sheet. When efficient mixing and spraying equipment is used, a pot-life of two hours or more for the catalysed resin solution is acceptable.

Besides the binder, the known admixtures may be added, such as moisture repellants, fungicides, anti-foaming agents etc.

Generally, pressing is carried out at a temperature of between 140 and 220 °C and at a pressure of up to 3.5 N/mm^2.

The process according to the invention will be explained by the following examples without being restricted to the modes of realisation described therein.

Example I

Urea-melamine-formaldehyde adhesive resin solutions were prepared from the following components:

a) A melamine formaldehyde resin solution obtained in the usual manner by condensation at 95-98 °C, with a molar formaldehyde to melamine ratio of 1.65.

b) A commercially available urea-formaldehyde resin solution with a molar formaldehyde to urea ratio of 1.25 (the commercial product UF-6 SGA of Methanol Chemie Nederland).

c) Urea.

By mixing components (a), (b) and (c), adhesive resin solutions were prepared having an effective molar F/NH_2 ratio of 0.45, and a melamine to urea weight ratio of 1:1. Using these adhesive solutions and diphenylmethanediisocyanate (MDI) as binder, chipboards were manufactured, for the rest in the usual manner. The UMF adhesive solutions were mixed with a standard catalyst (2 % ammonium chloride relative to the resin solids weight) and, depending on the desired reactivity, different amounts of 4 M hydrochloric acid.
Further, a moisture repellant was added (0.6 % Mobilcer paraffin emulsion, relative to the dry chip weight), and the adhesives were diluted with water down to a viscosity suitable for spraying.
The isocyanate was emulsified in the adhesive solution in the desired quantity, after which the mixture was sprayed on the chips.

The chipboard was manufactured by spraying dust-free wood chips (70 % wt. fir, 30 % wt. beech) with the binders in a suitable mixer and then strewing them into a mat, which at a pressing temperature of 180 °C, a maximum compressing force of 3.4 N/mm^2 and a pressing time of 8 seconds per mm sheet thickness was compressed into sheets of 40 x 40 cm, with a thickness of 16 mm and a density of about 700 kg/m^3.

The tensile strength of the sheets normal to the sheet surface after submersion for 2 hours in boiling water (V-100 tensile strength) was measured in accordance with DIN 68763.

The formaldehyde emission of the sheets was determined in accordance with modified DSM/WKI (Roffael) method. In this method, a chipboard sample is suspended over a saturated solution of common salt in a well sealed bottle at a temperature of 40 °C. The salt solution is renewed at subsequent intervals of 96 and 72 hours.

The quantity of formaldehyde absorbed into the salt solutions during the second (72-hour) cycle is determined and expressed in mg of formaldehyde per m^2 of chipboard. The composition of the adhesives, the quantity of binder used, relative to the dry ('atro') chip material, and the strength and the formaldehyde emission of the chipboard sheets have been summarized in Table I, series I.

Table I

test series	UMF molar ratio F/NH_2	accelerator system, % rel. to solid UMF		adhesive content		tensile strength V-100 N/mm^2	Q-24 %	F-emission (DSM/Roffael) mg F/m^2 x 72 h
		NH_4Cl	4N HCl	wt.% UMF	wt.% MDI			
I-1	0.45	2	3.8	7	2	0.34	7.0	90
2	"	"	"	9	1	0.33	7.3	80
3	"	"	"	11	0.5	0.32	7.3	75
4	"	"	15.4	7	2	0.29	7.1	65
5	"	"	"	9	1	0.32	6.9	60
6	"	"	"	11	0.5	0.36	6.2	60
II-7*	0.45	2	-	7	2	0.33	6.6	120
8*	"	"	-	9	1	0.30	7.5	110
9*	"	"	-	11	0.5	0.18	9.0	110
III**								
-10*	0.65	1.5	-	13	-	0.33	6.8	800
11*	"	3	-	13	-	0.34	5.5	700
12*	"	1.5	2.5	13	-	0.33	6.2	800

* not according to the invention.

** UMF adhesive obtained by mixing of MF-resin (a), UF-resin (b) and a small amount of formaldehyde.

Q-24 is the swell after storage for 24 hours under water at 20 °C, expressed as a percentage of the original thickness.

Example II (comparative example)

For the purpose of comparison, chipboard sheets were made with the same adhesive system as in Example I, except that no acid was added but only the standard accelerator was used (Table I, series II). At a low MDI content only a moderate V-100 tensile strength is achieved. Moreover, the formaldehyde emission is considerably higher when no acid is added than in the examples of series I.

At a higher molar ratio ($F/NH_2 = 0.65$; series III) addition of acid does give increased reactivity (which indeed can be achieved here also by addition of more NH_4Cl), but does not lead to improved mechanical quality, not even after the resin has fully set.

Example III

By mixing components (a), (b) and (c), as given in Example I, a melamine-modified UF adhesive was prepared having an effective molar ratio F/NH_2 of 0.50 and a melamine content of 7.7 % relative to resin solids.

Using this adhesive solution, chipboard sheets were pressed in the usual manner, using as the accelerator system standard catalyst (1.5 % NH_4Cl, referred to dry resin) and chlorhydric acid. Production data, dry tensile strength (V-20) and formaldehyde emission are summarised in Table II.

Table II

test series	UMF molar ratio F/NH_2	accelerator system % rel. to resin solids		adhesive content wt.% rel. to chips	pressing time sec/mm 180 °C	tensile strength V-20 (N/mm^2)	Q-24 %	F-emission (DSM/Roffael) mg F/m^2 72 h
		NH_4Cl	4NHCl					
14*	0.50	1.5	-	9	13	0.18	-	-
15*	"	"	-	"	17	0.43	16.1	105
16	0.50	1.5	7.5	9	10	0.33	-	-
17	"	"	"	"	13	0.53	11.6	-
18	"	"	"	"	17	0.54	12.5	104

* not according to the invention.

Example IV

Using the same binder system as in example I.3 (UMF adhesive solution with molar F/NH_2 ratio of 0.45, and MDI) chipboards were made, applying as catalyst a standard catalyst (NH_4Cl) and formic acid. The composition of the adhesive system, the quantity of binder used relative to dry ('atro') chip material and the strength and formaldehyde emission of the chipboard sheet are summarised in Table III.

Table III

test series	UMF molar ratio F/NH_2	accelerator system, % rel. to solid UMF		adhesive content		tensile strength V-100 N/mm^2	Q-24 %	F-emission (DSM/Roffael) mg F/m^2 x 72 h
		NH_4Cl	4N HCl	wt.% UMF	wt.% MDI			
IV	0.45	2	12	11	0.5	0.34	7.0	55

CLAIMS

1. Process of manufacturing sheets by providing particulate cellulose-containing material with a catalyst-containing, possibly melamine-modified urea-formaldehyde resin as a binder and pressing it into a sheet at elevated temperature and increased pressure, the process being characterized in that in the binder the molar formaldehyde-to-amino-groups ratio (F/NH_2) is between 0.25 and 0.625 and the catalyst comprises a mixture of a latent catalyst and a strong acid in an effective amount.
2. Process according to claim 1, characterized in that the amount of acid is sufficient to increase the reactivity to such an extent that the setting process can be completed at a pressing temperature of 180 °C in a period of 10 seconds or less per mm sheet thickness.
3. Process according to claim 1-2, characterized in that the binder comprises a combination of a polyisocyanate, in an amount of between 0.1 and 2.0 per cent by weight relative to the dry chips, with a urea-melamine-formaldehyde resin containing 25-70 per cent by weight of melamine, relative to melamine plus urea, and applied in an amount of between 6 and 14 per cent by weight, relative to the dry chips.
4. Process according to claim 3, characterized in that the amount of melamine is between 40 and 60 per cent by weight, the polyisocyanate content between 0.3 and 1.5 per cent by weight and the aminoplast resin content between 8 and 12 per cent by weight relative to dry chips, with a mixture of 1-3 per cent by weight of latent catalyst, relative to the resin, and strong acid in an amount of 20-80 meq/100 g resin as a catalyst.
5. Process according to claims 3-4, characterized in that the amount of strong acid is between 35 and 65 meq/100 g resin.
6. Process according to claims 3-5, characterized in that the acid is formic acid.
7. Process according to claims 3-6, characterized in that the F/NH_2 ratio is between 0.40 and 0.55.
8. Process according to claims 1-2, characterized in that as the sole bonding agent a urea-melamine-formaldehyde resin with a melamine content of 1-10 per cent by weight and a F/NH_2 ratio of 0.425 to 0.625 is used in an amount of 6-15 per cent by weight relative to the dry chips, with 1-3 per cent by weight, relative to the resin, of latent catalyst and 10-70 meq/100 g resin of strong acid.

9. Process according to claim 8, characterized in that the melamine content is between 2 and 8 per cent by weight, the F/NH_2 ratio is between 0.45 ad 0.55 and the amount of strong acid is between 20 and 50 meq/100 g resin.

10. Process according to claims 8-9, characterized in that the acid is sulphuric acid.

0107260

Application number

European Patent Office

EUROPEAN SEARCH REPORT

EP 83 20 1525

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. ³)
			C 08 L 97/02 C 08 L 61/24 C 08 L 61/30 C 09 J 3/00
D,Y	EP-A-0 025 245 (METHANOL CHEMIE NEDERLAND STAMICARBON) * Examples 1,2; claims * ---	1,3,4, 7-9	
Y	CHEMICAL ABSTRACTS, vol. 88, no. 2, 9th January 1978, page 43, no. 7976y, Columbus, Ohio, US & PL - A - 85 670 (AKADEMIA ROLNICZA) 15-10-1976 * Abstract * ---	1,2	
Y	CHEMICAL ABSTRACTS, vol. 87, no. 14, 3rd October 1977, page 30, no. 103073b, Columbus, Ohio, US & PL - A - 85 450 (AKADEMIA TOLNICZA) 15-09-1976 * Abstract * ---	1,2	
A	EP-A-0 013 447 (METHANOL CHEMIE NEDERLAND) * Page 1, lines 14-22; example 1; table; claims 1-3 * ---	1,3,4, 7	TECHNICAL FIELDS SEARCHED (Int. Cl. ³)
			C 08 L C 09 J
A	EP-A-0 062 389 (METHANOL CHEMIE NEDERLAND) * Example 3; claims * ---	1,7-9	
A	GB-A-2 019 854 (AKTIEBOLAGET CASCO) * Page 3, lines 5-10; examples IA,IB; claims 1,4-7 * -----	1-4	

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24-01-1984	FLETCHER A.S.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document
T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
& : member of the same patent family, corresponding document

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⑪ Publication number: **0 501 174 A1**

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⑤④ Hardening composition for urea-formaldehyde glues, process for its preparation and kit comprising it.

⑤⑦ The hardening composition for glues of the urea-formaldehyde type comprises an aqueous solution of an ammonium salt as polymerization catalyst for the urea-formaldehyde resin and, in emulsion with said aqueous solution, a resin deriving from the polymerization of one or more vinyl alcohol esters either with each other or with other monomers containing the vinyl group, said resin being able to cross-link in acidic surrounding.

The composition can further comprise other ingredients, such as an antifoaming agent, a metal salt having acidic reactivity which catalyzes the crosslinking of the vinyl resin, an inorganic filler, and urea which controls the catalytic activity of the ammonium salt.

The present invention relates to a hardening composition for urea-formaldehyde glues, to a process for its preparation and to a kit for its use together with urea-formaldehyde glues.

There are known hardening compositions based on aqueous solutions of an ammonium salt, particularly ammonium chloride, which act as a catalyst for polymerization reactions of urea-formaldehyde glues.

It is an object of the present invention to provide a hardening composition for urea-formaldehyde glues which composition improves the use properties of the polymerized glue, such as the adhesiveness, water resistance etc., while maintaining the hardening capacity substantially unchanged.

This object is achieved by a hardening composition of the above indicated type which is characterized in that it also comprises in emulsion with the ammonium salt solution, a resin deriving from the polymerization of one or more vinyl alcohol esters either with each other or with other monomers containing the vinyl group, said resin being able to cross-link in acidic surrounding.

This cross-linking capacity is obtained by polymerizing with the vinyl resin small amounts of reactive monomers, for example N-methylolacrylamide or triallylcyanurate. These reactive groups further control the cross-linking of the vinyl resin by attaching to the polymer chains of the urea-formaldehyde glue.

Examples of preferred vinyl resins are polyvinyl acetate, ethylene vinylacetate and polyvinyl propionate.

The presence of the vinyl resin in the emulsion improves the properties of pore filling, adhesion and water resistance of the polymerized glue after the addition of the hardening composition. The latter further guarantees a rapid hardening of the glue when the glue is brought together with the hardening composition at a temperature of about 100°.

In a preferred embodiment of the invention the hardening composition further comprises an antifoaming agent in adequate amount to avoid the formation of air bubbles therein.

Thus the composition is suitable for the use in automatic pumping and dosage systems which are currently used in the preparation of glue mixtures.

According to a preferred embodiment of the invention the hardening composition comprises a metal salt having acidic reactivity which acts as a catalyst for the cross-linking of the vinyl resin and, together with the ammonium salt, as a co-catalyst for the polymerization of the urea-formaldehyde adhesive. Such salts, which are generally good electrolytes, have the further advantage of rendering the hardening composition suitable to be heated by high frequency radiations.

Among the metal salts the preferred compounds are zinc chloride, chromium nitrate, aluminum nitrate and, in particular, aluminum chloride.

According to a preferred embodiment of the invention, the hardening composition further comprises an inorganic filler showing stability in acidic surrounding. Examples of such fillers are calcium sulfate, barium sulfate and preferably kaolin.

The inorganic filler, particularly kaolin, reinforces the achieved glue joints. Being compatible with the other ingredients, it further allows the compositon to be stored for long periods of time of at least up to six months.

In a further preferred embodiment of the invention the hardening composition also comprises urea.

The presence of this latter additive allows to control the catalytic activity of the ammonium salt during the polymerization of the glue. Urea, in particular, reduces this activity at room temperature or slightly higher temperatures, so that the mixture of hardener and glue may be applied without hurry to the surfaces to be adhered, while there is no decrease of catalytic activity at temperatures around 100°, at which the polymerization is usually carried out.

A further object of the present invention is a kit, comprising, separated from each other, a hardening composition of any one of the above described types and a urea-formaldehyde glue, which are to be mixed at the moment of use, the weight ratio between the hardening composition and the glue being between 0.15 and 0.30 and preferably 0.20.

A further object of the present invention is a process for the preparation of a hardening composition of the above described type, characterized in that it comprises the successive additions into a stirred vessel of the following ingredients: an aqueous emulsion of a cross-linking vinyl resin, an antifoaming agent, optionally an aqueous solution of a metal salt having acidic reactivity, an ammonium salt and water for its dissolution, and optionally urea, that optionally an inorganic filler is added to the other ingredients in two distinct steps after the addition of the aqueous solution of the aluminum chloride and of the urea, and that stirring is continued for 15 to 20 minutes after the addition of all ingredients has been completed.

In a preferred embodiment of the above indicated process, an aqueous solution of an ammonium salt is prepared in advance by dissolving the ammonium salt in water which had been preheated to a temperature between 40 and 55°, whereupon said solution is added to the other ingredients.

In particular, it was found to be advantageous to prepare hardening compositions of the following type by adding the ingredients in the indicated order:

1) emulsion of cross-linking vinyl resin	from 50 to 70 parts
2) antifoaming agent	from 0.1 to 0.5 parts
3) aqueous solution of aluminum chloride (water content 55 %)	from 0.5 to 3 parts
4) kaolin	from 5 to 10 parts
5) ammonium salt	from 4 to 6 parts
6) water	from 5 to 10 parts
7) urea	from 5 to 10 parts
8) kaolin	from 5 to 10 parts.

As indicated above, it is preferred to first dissolve the ammonium chloride in water (ingredients 5 and 6) and to then add the so prepared solution to the other ingredients in the indicated order. Kaolin is added in two distinct steps in order to enhance mixing with the other ingredients.

The essential properties of the obtained compositions are indicated in the following table:

Table I

Epprecht viscosity	700 to 3000 mPa.s
Brookfield viscosity	1500 to 7000 mPa.s
pH	3 to 3.5
solids content	55 to 65 %
specific weight	1.15 ± 0.1

It is important that the final pH-value of the composition stabilizes around at the above indicated values, because lower values may cause the hydrolysis of the vinyl resin, while higher values impair the subsequent polymerization reactions.

Further advantages and characteristics of the present invention will become apparent from the examples given below which examples are considered to be non-limiting.

Example 1

The following ingredients were added with stirring in the indicated sequence and quantities into a vessel:

emulsion of cross-linking polyvinyl acetate	60.0 parts
Nopco NDW (antifoaming agent)	0,3 parts
kaolin	9,7 parts
ammonium chloride	5,0 parts
water to dissolve the ammonium chloride	9 parts
urea	7 parts
kaolin	9 parts

The emulsion of the cross-linking polyvinyl acetate which was selected from commercially available produts had a solids content of 50 %.

As indicated above it is preferred to separately mix the ammonium chloride and water and to then add the so prepared solution to the other ingredients. When all ingredients have been added stirring in the vessel is continued for 15 to 20 minutes.

Example 2

The employed process is analogous to that of the preceding example. The following ingredients are used:

emulsion of slightly cross-linking polyvinyl acetate	25.48 parts
emulsion of highly cross-linking polyvinyl acetate	38.22 parts
Nopco (antifoaming agent)	0,3 parts
aqueous solution of $AlCl_3$ (water content 55 %)	1.3 parts
kaolin	7.7 parts
ammonium chloride	5 parts
water	8.00 parts
urea	7.00 parts
kaolin	7.00 parts

Both polyvinyl acetate emulsions used have a solids content of 50 %.

The following table indicates the essential physical properties of the two compositions obtained:

Table 2

	Example 1	Example 2
Epprecht viscosity t = 0	1900 mPa.s	800 mPa.s
Epprecht viscosity t = 5 days	1650 mPa.s	720 mPa.s
Epprecht viscosity t = 16 days	1700 mPa.s	750 mPa.s
stratification after 36 days	absent	absent
Brookfield viscosity, 20 rpm, 20° C, t = 0	5480 mPa.s	1900 mPa.s
pH	3.28	3.4
solids content	60.5 %	58 %
specific weight	1.16	1.14

Then the hardening compositions of the above described examples and a comparative hardening composition, prepared according to the prior art on the basis of ammonium chloride and without addition of an emulsion of a crosslinking vinyl resin, were separately mixed in a ratio of 20 to 100 with two resins of the liquid urea-formaldehyde type in order to evaluate the polymerization.

Of the two urea-formaldehyde resins used one had a mean reactivity and a content of free formaldehyde between 0.4 and 0.5 %, and the other had a high reactivity and a content of free formaldehyde between 1 and 1.2 %. The dry content of both urea-formaldehyde resins used was 65 ± 1 %.

The following table 3 summarizes the essential properties of the glue mixtures thus obtained.

Table 3

	liquid u.f.* resin with mean reactivity (dry content about 65 %)			liquid u.f. resin with high reactivity (dry content about 65)		
	comp. examp.	examp 1	examp. 2	comp. examp.	examp. 1	examp. 2
Epprecht visc. 20° C	280	450	400	260	440	420
pH	5,4	4,8	4,7	5,3	4,6	4,5
gelling time at 30° C	240'	205'	198'	88'	81'	82'
gelling time at 100° C	38"	35"	36"	31"	24"	25"
homogenity	good	good	good	good	good	good
prevention of exudation with a 6/10 veneering and a pressing temperature of 90° C	poor	good	good	good	good	good

* u.f. = urea-formaldehyde

Furthermore the water resistance of joints made with mixtures of adhesvies and hardining compositions of the above identified types was tested according to DIN 68705-IW67. The tests were carried out with glue mixtures consisting of the type having mean reactivity and hardening compositions according to examples 1 and 2 and the comparative example respectively. The weight ratio of the hardening compositon and the glue was 20 to 100.

Several plywood samples for testing were prepared in the laboratoy by adhering together 5 layers of beech-wood having a thickness of 1 mm. After conditioning, the samples were immersed in water at 67° for 3 hours and then subjected to a further immersion in cold water for 2 hours. The following table 4 shows the results of this test.

Table 4

liquid u.f. resin with mean reactivity admixed with a hardening composition according to	water resistance according to DIN 68705-IW67
comparative example	failure (the adhered layers separated after 15 to 20 min in warm water)
example 1	fully successful
example 2	satisfying (bonding force between the layers after immersion is acceptable but not as good as with the composition according to example 1)

Claims

1. Hardening composition for glues of the urea-formaldehyde type, comprising as polymerisation catalyst for the urea-formaldehyde resin an aqueous solution of an ammonium salt, characterized in that said composition furthermore comprises, in emulsion with said aqueous solution, a resin deriving from the polymerisation of one or more esters of vinyl alcohol either with each other or with other monomers containing the vinyl group, said resin being able to cross-link in acidic surrounding.

2. Hardening composition according to claim 1, characterized in that said vinyl resin is polyvinyl acetate, ethylene vinylacetate or polyvinyl propionate.

3. Hardening composition according to any one of the previous claims, characterized in that the emulsion further comprises an antifoaming agent in an effective amount to avoid the formation of air bubbles.

4. Hardening composition according to any one of the previous claims, characterized in that the emulsion further comprises a metal salt having acidic reactivity, preferably zinc chloride, chromium or aluminium nitrate or in particular aluminum chloride, in an effective amount to catalyze the cross-linking of the vinyl resin.

5. Hardening composition according to any one of the previous claims, characterized in that the emulsion further comprises an inorganic filler which is stable in acidic surrounding, preferably calcium sulfate, barium sulfate or in particular kaolin, in an effective amount to reinforce the glue joint.

6. Hardening composition according to any one of the previous claims, characterized in that the emulsion further comprises urea in an effective amount to control the catalytic activity of the ammonium salt.

7. Hardening composition according to any one of the previous claims, characterized in that it is obtainable by mixing the following ingredients in the indicated quantities:

- aqueous emulsion of cross-linking vinyl resin	from 50 to 70 parts
- antifoaming agent	from 0.1 to 0.5 parts
- aqueous solution of $AlCl_3$	from 0.5 to 3 parts
- kaolin	from 10 to 20 parts
- aqueous solution of ammonium salt	from 9 to 16 parts
- urea	from 5 to 10 parts.

8. Kit, comprising, separated from each other, a composition according to any one of the previous claims and a glue of the urea-formaldehyde type, intended to be mixed at the moment of use, the weight ratio between the hardening composition and the glue being between 0.15 and 0.30, preferably 0.2.

9. Process for the preparation of a hardening composition according to claims 1 to 7, characterized in that it comprises the successive additions into a stirred vessel of the following ingredients: an emulsion of a cross-linking vinyl resin, an antifoaming agent, optionally an aqueous solution of an aluminum salt, an aqueous solution of a metal salt having acidic reactivity, and optionally urea, that optionally an inorganic filler, which is stable in acidic surrounding, is added in two distinct steps after the addition of the aqueous solution of the aluminum chloride and the urea and that stirring is continued for 15 to 20 minutes after the addition of all ingredients has been completed.

10. Process according to claim 9, characterized in that the aqueous solution of the ammonium salt is prepared in advance by dissolving the ammonium salt in water, which had been previously heated to a temperature between 40 and 55 ° C, whereupon said solution of the ammonium salt is added to the other ingredients in the indicated order.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 92 10 1740

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	US-A-4 506 060 (J.T.WHITE ET AL.) * column 4, line 13 - line 24; claims 1-2 * ---	1-3	C09J61/24 C09J161/24
A	GB-A-1 567 033 (ICI) ---		
A	FR-A-2 373 577 (A.P.C. - AZOTE ET PRODUITS CHIMIQUES) ---		
A	DE-A-2 820 395 (EBNÖTHER) ---		
A	DE-A-3 008 218 (EBNÖTHER) ---		
A	US-A-4 018 959 (P.R.DEMKO) -----		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

C09J
C08L

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 JUNE 1992	STIENON P.M.E.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons
....
& : member of the same patent family, corresponding document

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SWE11195WOP1	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13/07/2012	(Earliest) Priority Date *(day/month/year)* 15/07/2011
Applicant AKZO NOBEL COATINGS INTERNATIONAL B.V.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language,** the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed
      ☐ a translation of the international application into ______________________ , which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. ☐ **Certain claims were found unsearchable** (See Box No. II)
3. ☐ **Unity of invention is lacking** (see Box No III)
4. With regard to the **title,**
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract,**
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority
6. With regard to the **drawings,**
   a. the figure of the **drawings** to be published with the abstract is Figure No. ____________
      ☐ as suggested by the applicant
      ☐ as selected by this Authority, because the applicant failed to suggest a figure
      ☐ as selected by this Authority, because this figure better characterizes the invention
   b. ☐ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063766

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08G8/10 C09J161/02 C09J161/28
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C08G C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, BEILSTEIN Data, CHEM ABS Data, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/040410 A1 (DYNEA OY [FI]; PEDERSEN ASTRID [NO]; SANDBAKKEN PER OLAV [NO]) 12 April 2007 (2007-04-12) page 1 - page 16, line 11; claims 1-11; examples	1-5
X	WO 03/033610 A1 (AKZO NOBEL NV [NL]; CASCO PRODUCTS AB [SE]; PIRHONEN SALME [SE]; NASLI) 24 April 2003 (2003-04-24) page 1, line 3 - page 8, line 6; claims 1-23; examples	1-15
X	EP 1 136 537 A1 (AKZO NOBEL NV [NL]) 26 September 2001 (2001-09-26) paragraph [0001] - paragraph [0049]; claims 1-19; examples	1-15

-/--

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search 31 July 2012	Date of mailing of the international search report 09/08/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Kiebooms, Rafaël

2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063766

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 062 389 A1 (METHANOL CHEMIE NEDERLAND [NL]) 13 October 1982 (1982-10-13) page 1 - page 4, line 13; claims 1-10; examples -----	1-15
X	EP 0 025 245 A2 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 18 March 1981 (1981-03-18) page 1 - page 5, line 22; claims 1-10; examples -----	1-15
X	EP 0 107 260 A1 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 2 May 1984 (1984-05-02) page 1, line 1 - page 4, line 2; claims 1-10; examples -----	1-15

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/063766

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007040410 A1	12-04-2007	AT 556123 T	15-05-2012
		DK 1945729 T3	23-07-2012
		EP 1945729 A1	23-07-2008
		WO 2007040410 A1	12-04-2007
WO 03033610 A1	24-04-2003	AT 361963 T	15-06-2007
		AU 2002339806 B2	25-08-2005
		AU 2002339807 B2	25-08-2005
		BR 0213276 A	26-10-2004
		BR 0213277 A	26-10-2004
		CA 2463635 A1	24-04-2003
		CA 2463636 A1	24-04-2003
		CN 1568357 A	19-01-2005
		CN 1571823 A	26-01-2005
		DE 60220085 T2	10-01-2008
		DK 1448741 T3	10-09-2007
		EP 1448740 A1	25-08-2004
		EP 1448741 A1	25-08-2004
		ES 2286294 T3	01-12-2007
		HU 0401780 A2	29-11-2004
		HU 0401796 A2	28-12-2004
		JP 4537706 B2	08-09-2010
		JP 2005505677 A	24-02-2005
		JP 2005505678 A	24-02-2005
		MY 135503 A	30-04-2008
		NO 20042038 A	15-07-2004
		NO 20042039 A	13-07-2004
		NZ 531995 A	23-12-2005
		NZ 531996 A	28-10-2005
		SI 1448741 T1	31-12-2007
		UA 77985 C2	15-02-2007
		WO 03033609 A1	24-04-2003
		WO 03033610 A1	24-04-2003
EP 1136537 A1	26-09-2001	AT 9585 U1	15-12-2007
		AT 328979 T	15-06-2006
		AU 4293801 A	03-10-2001
		AU 2001242938 B2	28-10-2004
		BR 0109305 A	17-12-2002
		CA 2403362 A1	27-09-2001
		CN 1419593 A	21-05-2003
		DE 01915994 T1	23-06-2005
		DE 20122619 U1	28-09-2006
		DE 60120376 T2	07-12-2006
		DK 1268700 T3	02-10-2006
		EE 200200536 A	15-04-2004
		EP 1136537 A1	26-09-2001
		EP 1268700 A1	02-01-2003
		ES 2266175 T3	01-03-2007
		FI 7319 U1	30-11-2006
		JP 4439784 B2	24-03-2010
		JP 2003528203 A	24-09-2003
		NO 20024443 A	15-11-2002
		NZ 521208 A	30-05-2003
		PL 357806 A1	26-07-2004
		SI 1268700 T1	30-04-2007
		SK 13412002 A3	11-09-2003
		US RE40730 E1	09-06-2009

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2001031825 A1	18-10-2001
		WO 0170898 A1	27-09-2001
EP 0062389 A1	13-10-1982	CA 1206655 A1	24-06-1986
		DE 3272092 D1	28-08-1986
		EP 0062389 A1	13-10-1982
		NL 8101700 A	01-11-1982
		US 4510278 A	09-04-1985
EP 0025245 A2	18-03-1981	CA 1166394 A1	24-04-1984
		DE 3068797 D1	06-09-1984
		DK 377180 A	12-03-1981
		EP 0025245 A2	18-03-1981
		FI 802829 A	12-03-1981
		NL 7906751 A	13-03-1981
		NO 802687 A	12-03-1981
		US 4362827 A	07-12-1982
EP 0107260 A1	02-05-1984	EP 0107260 A1	02-05-1984
		NL 8204144 A	16-05-1984
		NO 833915 A	30-04-1984

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SWE11195WOP1	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13.07.2012	Priority date *(day/month/year)* 15.07.2011

International Patent Classification (IPC) or national classification and IPC
INV. C08G8/10

Applicant
Akzo Nobel Coatings International B.V.

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   a. ☒ *sent to the applicant and to the International Bureau)* a total of 5 sheets, as follows:
      - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3*bis* of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒ Box No. I	Basis of the report
☐ Box No. II	Priority
☐ Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐ Box No. IV	Lack of unity of invention
☒ Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐ Box No. VI	Certain documents cited
☐ Box No. VII	Certain defects in the international application
☐ Box No. VIII	Certain observations on the international application

Date of submission of the demand 19.04.2013	Date of completion of this report 09.09.2013
Name and mailing address of the international preliminary examining authority: European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016	Authorized officer Kiebooms, Rafaël Telephone No. +31 70 340-2425

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2012/063766

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

☒ the international application in the language in which it was filed

☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:

☐ international search (under Rules 12.3(a) and 23.1(b))
☐ publication of the international application (under Rule 12.4(a))
☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-11	as originally filed	

Claims, Numbers

1-12	filed with the letter of	18-04-2013

☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages
☐ the claims, Nos.
☐ the drawings, sheets/figs
☐ the sequence listing *(specify)*:
☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):

☐ the description, pages
☐ the claims, Nos.
☐ the drawings, sheets/figs
☐ the sequence listing *(specify)*:

5. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 70.2 (e)).

6. ☐ Supplementary international search report(s) from Authority(ies) have been received and taken into account in drawing up this report (Rule 45bis.8(b) and (c)).

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1	WO 2007/040410 A1 (DYNEA OY [FI]; PEDERSEN ASTRID [NO]; SANDBAKKEN PER OLAV [NO]) 12 April 2007 (2007-04-12)
D2	WO 03/033610 A1 (AKZO NOBEL NV [NL]; CASCO PRODUCTS AB [SE]; PIRHONEN SALME [SE]; NASLI) 24 April 2003 (2003-04-24)
D3	EP 1 136 537 A1 (AKZO NOBEL NV [NL]) 26 September 2001 (2001-09-26)
D4	EP 0 062 389 A1 (METHANOL CHEMIE NEDERLAND [NL]) 13 October 1982 (1982-10-13)
D5	EP 0 025 245 A2 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 18 March 1981 (1981-03-18)
D6	EP 0 107 260 A1 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 2 May 1984 (1984-05-02)

2 The amendments filed with the letter dated 18-04-2013 do not introduce subject-matter which extends beyond the content of the application as filed, (Article 34(2)(b) PCT).

3 The application fulfils the requirements of Article 33(2) PCT.

3.1 D1 (claims 1,5,10) discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol, wherein the hardener part and/or the polymer dispersion part can contain a functionalized polyvinylacetate (PVAc). D1 (page 9, lines 13-15) discloses the amount of urea to be from about 1 to about 15 % by weight of the adhesive system.

The adhesive system of claim 1 of the application comprises less than 0.9 wt % of urea based on the weight of the entire adhesive system.

3.2 D2 (claim 1) discloses an adhesive system comprising a melaminic amino resin and a phenolic resin composition, which comprises an acid. D2 (page 3, lines 17-20) discloses that the"aldehyde to amino compound ratio", which is the molar ratio aldehyde to amino compound used when making the amino resin of the claimed adhesive system, is suitably less than 2.4, preferably from about 0.5 to about 2. 3, most preferably from about 0.7 to about 2. D2 (page 3, lines 29-30) discloses that homopolymers or copolymers of vinylesters, such as vinyl acetate, vinyl propionate, and vinyl butyrate, may also be used as components of the composition.

D2 does not disclose all the components in one single embodiment. D2 also does not discloses the F/NH2 ratio as defined in present claim 1 of the application, namely as molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups.

3.3 D3 (claims 1,10-12) discloses an adhesive system characterised in that it comprises, (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and optionally (d) a polyvinyl alcohol. The polymer (b) is a copolymer of vinyl acetate and N-methylol-acrylamid and the curing agent (c) is a carboxylic acid.

D3 however does not disclose the F/NH2 ratio as defined in claim 1 of the application or any equivalent parameter.

3.4 D4-D6 all relate to UF resins with low F/NH2 ratio to be used for particle board hardened and pressed at elevated temperatures.

However, none of D4-D6 discloses that the adhesive system comprises an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or polyethylene vinylacetate (EVA).

4 The subject-matter of the claims involves the presence of an inventive step (Article 33(3) PCT).

4.1 Technical field and problem of the application.

- technical field: adhesive systems comprising amino resins for producing wood based products
- problem: providing an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

4.2 Document D1 can be selected to represent the closest prior art because D1 (claims 1,5,10) discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol, wherein the hardener part and/or the polymer dispersion part can contain a functionalized polyvinylacetate (PVAc). D1 (page 9, lines 13-15) discloses the amount of urea to be from about 1 to about 15 % by weight of the adhesive system.

4.3 The difference between the closest prior art and the application is that the adhesive system of claim 1 of the application comprises less than 0.9 wt% of urea based on the weight of the entire adhesive system.

4.4 The effect of this difference is shorter press times and low formaldehyde emissions as shown in the examples and comparative examples (description, pages 9-11).

4.5 The objective technical problem in view of the closest prior art can therefore be formulated as providing an adhesive system which results in shorter press times and low formaldehyde emissions.

4.6 This is not obvious for the following reasons:

Starting from D1 the skilled person with the aim of providing an adhesive system enabling both short press time and low emissions would not even consider omitting or lowering the amount of urea because D1 teaches explicitly to work within a range of about 1% to about 15% by weight of the adhesive system. None of the cited documents D2-D6 provides any indication to modify the amount of urea in order to achieve shorter press times and lower formaldehyde emissions. The skilled person starting from D1 would not find the required information to modify the teaching of D1 in order to arrive at the subject-matter of claim 1. Claim 1 thus involves the presence of an inventive step. Claims 2-12 are dependent on claim 1 and thus also involve the presence of an inventive step.

As a consequence the presence of an inventive step can be acknowledged.

Akzo Nobel N.V.
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European Patent Office
Patentlaan 2
2280 HV RIJSWIJK
The Netherlands

April 18, 2013

Your ref: PCT/EP2012/063766
Our ref : SWE11195 WOP1

Re: International Patent Application No. PCT/EP2012/063766
Applicant: Akzo Nobel Coatings International B.V.

Dear Sirs,

Reference is made to the Written Opinion by the International Search Authority pursuant to Rule 43bis.1 PCT dated August 9, 2012 in respect of the above-identified application. Hereby by a new set of amended claims is submitted along with the following observations:

Amendments

Claim 1 has been amended by specifying the polymer to comprise at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA), which is supported by original claim 8. As a consequence, claims 6-8 have been deleted, while claims 9-15 have been renumbered and their dependencies brought into conformance with the new numbering.

Claim 1 has been further amended by including the definition of the F/NH_2 ratio as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, which is supported by the original description page 3, lines 13-15.

Clarity

The objections to the clarity have been overcome by the claim amendments.

The Invention

The present invention relates to an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous dispersion of at least one polymer comprising at

least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA); wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

It has been found that the invention solves the problem of providing an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

Cited documents

D1 = WO 2007/040410

D2 = WO 03/033610

D3 = EP 1136537

D4 = EP 0062389

D5 = EP0025245

D6 = EP 0107260

Novelty

The International Search Authority has asserted that the claims lack novelty since all documents D1-D6 disclose urea based amino resins with the proper F/NH$_2$ ratio and a hardener compound. However, as will be shown below none of the documents do disclose all features of claim 1.

D1 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

The adhesive system of present claim 1 is distinguished from D1 by specifying that it comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

D2 discloses an adhesive system comprising a melaminic amino resin composition and a phenolic resin composition. The most preferred molar ratio aldehyde to amino compound is from about 0.7 to about 2. However, no preferred F/NH$_2$ is mentioned for resins predominantly based on urea.

The adhesive system of present claim 1 is distinguished from D2 by the combination of the claimed F/NH$_2$ ratio in a urea based amino resin (meaning that urea constitutes from 75 to 100 wt% of compounds carrying -NH$_2$ or -NH groups) and further in combination with a polymer dispersion comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA). Such a combination can only be arrived at by combining several lists and sub-ranges and does constitute a novel selection that is not unambiguously derivable from D2.

D3 discloses an adhesive system comprising an etherified amino resin. However, the F/NH$_2$ or any equivalent parameter is not disclosed and D3 cannot for this reason anticipate present claim 1.

D4-D6 all relate to UF resins with low F/NH$_2$ ratio to be used for particle board pressed at very high temperatures. However, none of D4-D6 discloses any

adhesive system comprising a dispersion of a polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA) as recited in present claim 1.

Accordingly, it is evident that none of the cited documents destroy the novelty of present claim 1.

Claims 2-12 include all limitations of claim 1 and are novel for the same reason.

Inventive step

The International Search Authority Examiner has not discussed the inventive step. Nevertheless, it is submitted that there is no ground for lack of inventive step.

Reasonably D1 is regarded as the closest prior art as has the highest amount of structural similarities as the present invention and also relate to the same problem.

As set out above, claim 1 of the present application is distinguished from D1 by specifying that the adhesive system comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

As shown in the Examples of the present application the claimed combination of the specified F/NH_2 and absence of urea gave both short press time and low emissions. On the other hand, with significant amounts or urea in the system, the press time required for giving sufficient bond strength was significantly longer. Furthermore, with systems based on Hardener 4 representing D1 (WO 2007/040410) sufficient bond strength for passing the test was not even reached. Thus, it is apparent that the distinguishing features do solve the problem.

A person skilled in the art starting from D1 and aiming at solving the problem of providing an adhesive system enabling both short press time and low emissions would not even consider omitting or lower the amount of urea since this would go against the entire teaching of D1. Furthermore, none of D2-D6 provides any incentive to go against this teaching in order to solve the above problem. Therefore, claim 1 of the present application cannot have been obvious to a person skilled in the art and does for this reason involve an inventive step.

Claims 2-12 include all limitations of claim 1 and are inventive for the same reason.

Final remarks

In view of the above submissions it is requested that a positive International Preliminary Examination Report is issued for the new claims filed. Should there be any outstanding objections, it is requested that the International Preliminary Examination Authority issues a further Written Opinion or, if such objections are believed to be possible to easily resolve, contacts the undersigned agent for a telephone discussion.

Yours faithfully,

Christer Jönsson
(Association No. 485 – G.A. 598670.8)

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA);

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

7. Adhesive system as claimed in any one of the claims 1-6, wherein the hardener component comprise at least one aluminium salt.

8. Adhesive system as claimed in any one of the claims 1-7, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

9. Adhesive system as claimed in any one of the claims 1-8, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

10. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-9 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

11. Wood based product obtainable by the method according to claim 10.

12. Use of an adhesive system according to any one of the claims 1-9 for joining one or more pieces of a wooden material with one or more further pieces of a material.

Electronic Acknowledgement Receipt

EFS ID:	19123195
Application Number:	14131606
International Application Number:	
Confirmation Number:	4983
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	26646
Filer:	Kevin Todd Godlewski/Neil Benowitz
Filer Authorized By:	Kevin Todd Godlewski
Attorney Docket Number:	13877/48501
Receipt Date:	26-MAY-2014
Filing Date:	08-JAN-2014
Time Stamp:	10:21:09
Application Type:	U.S. National Stage under 35 USC 371

Payment information:

Submitted with Payment	no

File Listing:

Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1	Petition to make special under Patent Prosecution Hwy	13877-48501-PPH-IPRP.pdf	1364960 2c7f65f16761874d915b068446f99c61ff84538b	no	13

Warnings:

Information:

2	Information Disclosure Statement (IDS) Form (SB08)	IDS.pdf	612899 79bf183092a0662f1a312eecc9bbac0786fec7cb	no	5
Warnings:					
Information:					
3	Foreign Reference	WO-2007-040410.pdf	1613301 6afeace21340c60e0af4c9cae51f2ba1e31991ab	no	34
Warnings:					
Information:					
4	Foreign Reference	WO-03-033610.pdf	822223 9fb86316d8d6fb73ebecfc5dd6332dbb8fd8a4f2	no	15
Warnings:					
Information:					
5	Foreign Reference	WO-01-070898.pdf	659206 9c0696551a294bae86f6b75dbd471f990934d2ec	no	14
Warnings:					
Information:					
6	Foreign Reference	WO-2002-068178.pdf	1143864 d3ecf8892959796711fd8c430fceb8bb7e917223	no	26
Warnings:					
Information:					
7	Foreign Reference	EP1136537A1.pdf	526953 18991922650b6c708be92a16e4774152725e9e89	no	9
Warnings:					
Information:					
8	Foreign Reference	EP0062389.pdf	500127 980af4eee5887c286a223beef2533e7f6aa93a0d	no	11
Warnings:					
Information:					
9	Foreign Reference	EP0025245.pdf	528733 ef3b055aa650fb7070159e301722b2983c4b3c48	no	13
Warnings:					
Information:					
10	Foreign Reference	EP0107260A1.pdf	412067 f508f435b50f4dcf420eec782ac8ebf0e83c2021	no	11
Warnings:					
Information:					

11	Foreign Reference	ep0501174.pdf	376075 8ef96f3636b566e73029d7017bcec4976b5f55c7	no	7
Warnings:					
Information:					
12	Non Patent Literature	ISR.pdf	166631 8ca8539f868916a3df81470d6f0ea48e5c3ce742	no	5
Warnings:					
Information:					
13	Non Patent Literature	IPRP.pdf	459069 a1e07e963b8b775325c5c20889c228d666ba1904	no	11
Warnings:					
Information:					
		Total Files Size (in bytes):	9186108		

This Acknowledgement Receipt evidences receipt on the noted date by the USPTO of the indicated documents, characterized by the applicant, and including page counts, where applicable. It serves as evidence of receipt similar to a Post Card, as described in MPEP 503.

<u>New Applications Under 35 U.S.C. 111</u>

If a new application is being filed and the application includes the necessary components for a filing date (see 37 CFR 1.53(b)-(d) and MPEP 506), a Filing Receipt (37 CFR 1.54) will be issued in due course and the date shown on this Acknowledgement Receipt will establish the filing date of the application.

<u>National Stage of an International Application under 35 U.S.C. 371</u>

If a timely submission to enter the national stage of an international application is compliant with the conditions of 35 U.S.C. 371 and other applicable requirements a Form PCT/DO/EO/903 indicating acceptance of the application as a national stage submission under 35 U.S.C. 371 will be issued in addition to the Filing Receipt, in due course.

<u>New International Application Filed with the USPTO as a Receiving Office</u>

If a new international application is being filed and the international application includes the necessary components for an international filing date (see PCT Article 11 and MPEP 1810), a Notification of the International Application Number and of the International Filing Date (Form PCT/RO/105) will be issued in due course, subject to prescriptions concerning national security, and the date shown on this Acknowledgement Receipt will establish the international filing date of the application.

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U.S. APPLICATION NUMBER NO.	FIRST NAMED APPLICANT	ATTY. DOCKET NO.
14/131,606	Jenny Adrian Meredith	13877/48501

26646
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

INTERNATIONAL APPLICATION NO.	
PCT/EP2012/063766	
I.A. FILING DATE	PRIORITY DATE
07/13/2012	07/15/2011

CONFIRMATION NO. 4983
371 ACCEPTANCE LETTER

OC000000066961859

Date Mailed: 03/10/2014

NOTICE OF ACCEPTANCE OF APPLICATION UNDER 35 U.S.C 371 AND 37 CFR 1.495

The applicant is hereby advised that the United States Patent and Trademark Office, in its capacity as a Designated / Elected Office (37 CFR 1.495), has ACCEPTED the above identified international application for national patentability examination in the United States Patent and Trademark Office.

The United States Application Number assigned to the application is shown above and the relevant dates are:

01/08/2014	01/08/2014
DATE OF RECEIPT OF 35 U.S.C. 371(c)(1), (c)(2) and (c)(4) REQUIREMENTS	DATE OF COMPLETION OF ALL 35 U.S.C. 371 REQUIREMENTS

A Filing Receipt (PTO-103X) will be issued for the present application in due course. **THE DATE APPEARING ON THE FILING RECEIPT AS THE " FILING DATE" IS THE DATE ON WHICH THE LAST OF THE 35 U.S.C. 371 (c)(1), (c)(2) and (c)(4) REQUIREMENTS HAS BEEN RECEIVED IN THE OFFICE. THIS DATE IS SHOWN ABOVE.** *The filing date of the above identified application is the international filing date of the international application (Article 11(3) and 35 U.S.C. 363).*

The following items have been received:

- Copy of the International Application filed on 01/08/2014
- Copy of the International Search Report filed on 01/08/2014
- Copy of IPE Report filed on 01/08/2014
- Preliminary Amendments filed on 01/08/2014
- Inventor's Oath or Declaration filed on 01/08/2014
- Request for Immediate Examination filed on 01/08/2014
- U.S. Basic National Fees filed on 01/08/2014
- Priority Documents filed on 01/08/2014
- Power of Attorney filed on 01/08/2014
- Specification filed on 01/08/2014
- Claims filed on 01/08/2014
- Abstracts filed on 01/08/2014
- Application Data Sheet (37 CFR 1.76) filed on 01/08/2014

Applicant is reminded that any communications to the United States Patent and Trademark Office must be mailed to the address given in the heading and include the U.S. application no. shown above (37 CFR 1.5)

RODERICK M JONES

Telephone: (571) 272-9083

UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NUMBER	FILING or 371(c) DATE	GRP ART UNIT	FIL FEE REC'D	ATTY.DOCKET.NO	TOT CLAIMS	IND CLAIMS
14/131,606	01/08/2014		1480	13877/48501	20	1

CONFIRMATION NO. 4983

26646
KENYON & KENYON LLP
ONE BROADWAY
NEW YORK, NY 10004

FILING RECEIPT

OC000000066961858

Date Mailed: 03/10/2014

Receipt is acknowledged of this non-provisional patent application. The application will be taken up for examination in due course. Applicant will be notified as to the results of the examination. Any correspondence concerning the application must include the following identification information: the U.S. APPLICATION NUMBER, FILING DATE, NAME OF APPLICANT, and TITLE OF INVENTION. Fees transmitted by check or draft are subject to collection. Please verify the accuracy of the data presented on this receipt. **If an error is noted on this Filing Receipt, please submit a written request for a Filing Receipt Correction. Please provide a copy of this Filing Receipt with the changes noted thereon. If you received a "Notice to File Missing Parts" for this application, please submit any corrections to this Filing Receipt with your reply to the Notice. When the USPTO processes the reply to the Notice, the USPTO will generate another Filing Receipt incorporating the requested corrections**

Inventor(s)

Jenny Adrian Meredith, Arsta, SWEDEN;
Anna Kristina Furberb, Stockholm, SWEDEN;
Eugeniuez Abram, Solna, SWEDEN;
Benyahia Nasli-Bakir, Saltsjo-boo, SWEDEN;
Salme Pirhonen, Sollentuna, SWEDEN;

Applicant(s)

Jenny Adrian Meredith, Arsta, SWEDEN;
Anna Kristina Furberb, Stockholm, SWEDEN;
Eugeniuez Abram, Solna, SWEDEN;
Benyahia Nasli-Bakir, Saltsjo-boo, SWEDEN;
Salme Pirhonen, Sollentuna, SWEDEN;

Assignment For Published Patent Application

AKZO NOBEL COATINGS INTERNATIONAL B.V., ARNHEM, NETHERLANDS

Power of Attorney: The patent practitioners associated with Customer Number 26646

Domestic Priority data as claimed by applicant

This application is a 371 of PCT/EP2012/063766 07/13/2012
which claims benefit of 61/508,205 07/15/2011

Foreign Applications (You may be eligible to benefit from the **Patent Prosecution Highway** program at the USPTO. Please see http://www.uspto.gov for more information.)
EUROPEAN PATENT OFFICE (EPO) 11174128.6 07/15/2011

If Required, Foreign Filing License Granted: 03/05/2014

The country code and number of your priority application, to be used for filing abroad under the Paris Convention, is **US 14/131,606**

Projected Publication Date: 06/19/2014

Non-Publication Request: No

Early Publication Request: No
Title

ADHESIVE SYSTEM

Preliminary Class

Statement under 37 CFR 1.55 or 1.78 for AIA (First Inventor to File) Transition Applications: No

PROTECTING YOUR INVENTION OUTSIDE THE UNITED STATES

Since the rights granted by a U.S. patent extend only throughout the territory of the United States and have no effect in a foreign country, an inventor who wishes patent protection in another country must apply for a patent in a specific country or in regional patent offices. Applicants may wish to consider the filing of an international application under the Patent Cooperation Treaty (PCT). An international (PCT) application generally has the same effect as a regular national patent application in each PCT-member country. The PCT process **simplifies** the filing of patent applications on the same invention in member countries, but **does not result** in a grant of "an international patent" and does not eliminate the need of applicants to file additional documents and fees in countries where patent protection is desired.

Almost every country has its own patent law, and a person desiring a patent in a particular country must make an application for patent in that country in accordance with its particular laws. Since the laws of many countries differ in various respects from the patent law of the United States, applicants are advised to seek guidance from specific foreign countries to ensure that patent rights are not lost prematurely.

Applicants also are advised that in the case of inventions made in the United States, the Director of the USPTO must issue a license before applicants can apply for a patent in a foreign country. The filing of a U.S. patent application serves as a request for a foreign filing license. The application's filing receipt contains further information and guidance as to the status of applicant's license for foreign filing.

Applicants may wish to consult the USPTO booklet, "General Information Concerning Patents" (specifically, the section entitled "Treaties and Foreign Patents") for more information on timeframes and deadlines for filing foreign patent applications. The guide is available either by contacting the USPTO Contact Center at 800-786-9199, or it can be viewed on the USPTO website at http://www.uspto.gov/web/offices/pac/doc/general/index.html.

For information on preventing theft of your intellectual property (patents, trademarks and copyrights), you may wish to consult the U.S. Government website, http://www.stopfakes.gov. Part of a Department of Commerce initiative, this website includes self-help "toolkits" giving innovators guidance on how to protect intellectual property in specific countries such as China, Korea and Mexico. For questions regarding patent enforcement issues, applicants may call the U.S. Government hotline at 1-866-999-HALT (1-866-999-4258).

LICENSE FOR FOREIGN FILING UNDER

Title 35, United States Code, Section 184

Title 37, Code of Federal Regulations, 5.11 & 5.15

GRANTED

The applicant has been granted a license under 35 U.S.C. 184, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" followed by a date appears on this form. Such licenses are issued in all applications where the conditions for issuance of a license have been met, regardless of whether or not a license may be required as set forth in 37 CFR 5.15. The scope and limitations of this license are set forth in 37 CFR 5.15(a) unless an earlier license has been issued under 37 CFR 5.15(b). The license is subject to revocation upon written notification. The date indicated is the effective date of the license, unless an earlier license of similar scope has been granted under 37 CFR 5.13 or 5.14.

This license is to be retained by the licensee and may be used at any time on or after the effective date thereof unless it is revoked. This license is automatically transferred to any related applications(s) filed under 37 CFR 1.53(d). This license is not retroactive.

The grant of a license does not in any way lessen the responsibility of a licensee for the security of the subject matter as imposed by any Government contract or the provisions of existing laws relating to espionage and the national security or the export of technical data. Licensees should apprise themselves of current regulations especially with respect to certain countries, of other agencies, particularly the Office of Defense Trade Controls, Department of State (with respect to Arms, Munitions and Implements of War (22 CFR 121-128)); the Bureau of Industry and Security, Department of Commerce (15 CFR parts 730-774); the Office of Foreign AssetsControl, Department of Treasury (31 CFR Parts 500+) and the Department of Energy.

NOT GRANTED

No license under 35 U.S.C. 184 has been granted at this time, if the phrase "IF REQUIRED, FOREIGN FILING LICENSE GRANTED" DOES NOT appear on this form. Applicant may still petition for a license under 37 CFR 5.12, if a license is desired before the expiration of 6 months from the filing date of the application. If 6 months has lapsed from the filing date of this application and the licensee has not received any indication of a secrecy order under 35 U.S.C. 181, the licensee may foreign file the application pursuant to 37 CFR 5.15(b).

PATENT APPLICATION FEE DETERMINATION RECORD
Substitute for Form PTO-875

Application or Docket Number
14/131,606

APPLICATION AS FILED - PART I

FOR	NUMBER FILED (Column 1)	NUMBER EXTRA (Column 2)	SMALL ENTITY RATE($)	SMALL ENTITY FEE($)		OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY FEE($)
BASIC FEE (37 CFR 1.16(a), (b), or (c))	N/A	N/A	N/A		OR	N/A	280
SEARCH FEE (37 CFR 1.16(k), (i), or (m))	N/A	N/A	N/A			N/A	480
EXAMINATION FEE (37 CFR 1.16(o), (p), or (q))	N/A	N/A	N/A			N/A	720
TOTAL CLAIMS (37 CFR 1.16(i))	20 minus 20 =	*			OR	x 80 =	0.00
INDEPENDENT CLAIMS (37 CFR 1.16(h))	1 minus 3 =	*				x 420 =	0.00
APPLICATION SIZE FEE (37 CFR 1.16(s))	If the specification and drawings exceed 100 sheets of paper, the application size fee due is $310 ($155 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).						0.00
MULTIPLE DEPENDENT CLAIM PRESENT (37 CFR 1.16(j))							0.00
			TOTAL			TOTAL	1480

* If the difference in column 1 is less than zero, enter "0" in column 2.

APPLICATION AS AMENDED - PART II

		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)		OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT A	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

		CLAIMS REMAINING AFTER AMENDMENT (Column 1)		HIGHEST NUMBER PREVIOUSLY PAID FOR (Column 2)	PRESENT EXTRA (Column 3)	SMALL ENTITY RATE($)	SMALL ENTITY ADDITIONAL FEE($)		OTHER THAN SMALL ENTITY RATE($)	OTHER THAN SMALL ENTITY ADDITIONAL FEE($)
AMENDMENT B	Total (37 CFR 1.16(i))	*	Minus	**	=	x =		OR	x =	
	Independent (37 CFR 1.16(h))	*	Minus	***	=	x =		OR	x =	
	Application Size Fee (37 CFR 1.16(s))									
	FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM (37 CFR 1.16(j))							OR		
						TOTAL ADD'L FEE		OR	TOTAL ADD'L FEE	

* If the entry in column 1 is less than the entry in column 2, write "0" in column 3.
** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20".
*** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3".
The "Highest Number Previously Paid For" (Total or Independent) is the highest found in the appropriate box in column 1.

MULTIPLE DEPENDENT CLAIM FEE CALCULATION SHEET

Substitute for Form PTO-1360
(For use with Form PTO/SB/06)

Application Number
14131606

Filing Date

Applicant(s) Jenny ADRIAN MEREDITH

* May be used for additional claims or amendments

CLAIMS	AS FILED		AFTER FIRST AMENDMENT		AFTER SECOND AMENDMENT	
	Indep	Depend	Indep	Depend	Indep	Depend
1	1		---	---		
2		1	---	---		
3		1	---	---		
4		3	---	---		
5		3	---	---		
6		(1)	---	---		
7		(1)	---	---		
8		(1)	---	---		
9		(1)	---	---		
10		(1)	---	---		
11		(1)	---	---		
12		(1)	---	---		
13		(1)	---	---		
14		(1)	---	---		
15		(1)	---	---		
16			1			
17				1		
18				1		
19				1		
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Total Indep	1		1		0	
Total Depend	18	↵	19	↵	0	↵
Total Claims	19	▨	20	▨	0	▨

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	Indep	Depend	Indep	Depend	Indep	Depend
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PTO-1390 (05-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A SUBMISSION UNDER 35 U.S.C. 371		Attorney Docket No. 13877/48501 U.S. Application No. (if known, see 37 CFR 1.5) To be assigned
International Application No. PCT/EP2012/063766	International Filing Date July 13, 2012	Priority Date Claimed July 15, 2011; July 15, 2011
Title of Invention ADHESIVE SYSTEM		
First Named Inventor Jenny ADRIAN MEREDITH		

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information.

1. ☑ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). NOTE: The express request under 35 U.S.C. 371(f) will not be effective unless the requirements under 35 U.S.C. 371(c)(1), (2), and (4) for payment of the basic national fee, copy of the International Application and English translation thereof (if required), and the oath or declaration of the inventor(s) have been received.
2. ☑ A copy of the International Application (35 U.S.C. 371(c)(2)) is attached hereto (not required if the International Application was previously communicated by the International Bureau or was filed in the United States Receiving Office (RO/US)).
3. An English language translation of the International Application (35 U.S.C. 371(c)(2))
   a. ☐ is attached hereto.
   b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
4. An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4))
   a. ☑ is attached.
   b. ☐ was previously filed in the international phase under PCT Rule 4.17(iv).

Items 5 to 8 below concern amendments made in the international phase.

PCT Article 19 and 34 amendments

5. ☐ Amendments to the claims under PCT Article 19 are attached (not required if communicated by the International Bureau) (35 U.S.C. 371(c)(3)).
6. ☐ English translation of the PCT Article 19 amendment is attached (35 U.S.C. 371(c)(3)).
7. ☐ English translation of annexes (Article 19 and/or 34 amendments only) of the International Preliminary Examination Report is attached (35 U.S.C. 371(c)(5)).

Cancellation of amendments made in the international phase

8a. ☐ Do not enter the amendment made in the international phase under PCT Article 19.

8b. ☐ Do not enter the amendment made in the international phase under PCT Article 34.

NOTE: A proper amendment made in English under Article 19 or 34 will be entered in the U.S. national phase application absent a clear instruction from applicant not to enter the amendment(s).

The following items 9 to 17 concern a document(s) or information included.

9. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
10. ☑ A preliminary amendment.
11. ☑ An Application Data Sheet under 37 CFR 1.76.
12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b).
13. ☑ A power of attorney and/or change of address letter.
14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821-1.825.
15. ☐ Assignment papers *(cover sheet and document(s))*. Name of Assignee: ____________________
16. ☐ 37 CFR 3.73(c) Statement *(when there is an Assignee)*.

PTO-1390 (05-13)
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U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

U.S. APPLN. No. (if known – see 37 CFR 1.5)	INTERNATIONAL APPLICATION No.	ATTORNEY DOCKET No.
To be assigned	PCT/EP2012/063766	13877/48501

17. ☑ Other items or information:

International Search Report and Written Opinion of the ISA, Reply to the Written Opinion of the ISA, and International Preliminary Report on Patentability including annexes.

The following fees have been submitted.	CALCULATIONS	PTO USE ONLY
18. ☑ Basic national fee (37 CFR 1.492(a)) **$280**	$ 280.00	
19. ☑ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) .... **$0** All other situations **$720**	$ 720.00	
20. ☑ Search fee (37 CFR 1.492(b)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) .... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority ....**$120** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB ....**$480** All other situations **$600**	$ 480.00	
TOTAL OF 18, 19, and 20 =	$ 1,480.00	
☐ Additional fee for specification and drawings filed in paper over 100 sheets (excluding sequence listing in compliance with 37 CFR 1.821(c) or (e) in an electronic medium or computer program listing in an electronic medium) (37 CFR 1.492(j)). Fee for each additional 50 sheets of paper or fraction thereof **$400**	0	

Total Sheets	Extra Sheets	Number of each addition 50 or fraction thereof (round **up** to a whole number)	RATE	
- 100 =	/ 50 =		x **$400**	$

	CALCULATIONS	PTO USE ONLY
Surcharge of **$140.00** for furnishing any of the search fee, examination fee, or the oath or declaration after the date of commencement of the national stage (37 CFR 1.492(h)).	$ 0	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	20 - 20 =	0	x **$80**	$ 0	
Independent claims	1 - 3 =	0	x **$420**	$ 0	
MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$780**	$ 0	

	CALCULATIONS	PTO USE ONLY
Processing fee of **$140.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). +	$ 0	
TOTAL OF ABOVE CALCULATIONS =	$ 1,480.00	
☐ **Applicant asserts small entity status.** See 37 CFR 1.27. Fees above are reduced by ½.		
☐ **Applicant certifies micro entity status.** See 37 CFR 1.29. Fees above are reduced by ¼. Applicant must attach form PTO/SB/15A or B or equivalent.		
TOTAL NATIONAL FEE =	$ 1,480.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). **$40.00** per property. +	$ 0	
TOTAL FEES ENCLOSED =	$ 1,480.00	
	Amount to be refunded:	$
	Amount to be charged:	$

PTO-1390 (05-13)
Approved for use through 6/30/2013. OMB 0651-0021
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

a. ☐ A check in the amount of $__________ to cover the above fees is enclosed.

b. ☐ Please charge my Deposit Account No. __________ in the amount of $__________ to cover the above fees.

c. ☑ The Director is hereby authorized to charge additional fees which may be required, or credit any overpayment, to Deposit Account No. 11-0600 as follows:

- i. ☑ any required fee.
- ii. ☐ any required fee except for excess claims fees required under 37 CFR 1.492(d) and (e) and multiple dependent claim fee required under 37 CFR 1.492(f).

d. ☑ Fees are to be charged to a credit card. **WARNING:** Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038. The PTO-2038 should only be mailed or faxed to the USPTO. However, when paying the basic national fee, the PTO-2038 may NOT be faxed to the USPTO.

ADVISORY: If filing by EFS-Web, do **NOT** attach the PTO-2038 form as a PDF along with your EFS-Web submission. Please be advised that this is **not** recommended and by doing so your **credit card information may be displayed via PAIR**. To protect your information, it is recommended to pay fees online by using the electronic payment method.

NOTE: Where an appropriate time limit under 37 CFR 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the International Application to pending status.

Correspondence Address

☑ The address associated with Customer Number: 26646 **OR** ☐ Correspondence address below

Name					
Address					
City		State		Zip Code	
Country			Telephone		
Email					

Signature	/Kevin T. Godlewski/	Date	January 8, 2014
Name (Print/Type)	Kevin T. Godlewski	Registration No. (Attorney/Agent)	47,598

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12. ☐ A substitute specification. NOTE: A substitute specification cannot include claims. See 37 CFR 1.125(b).
13. ☑ A power of attorney and/or change of address letter.
14. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13*ter*.3 and 37 CFR 1.821-1.825.
15. ☐ Assignment papers *(cover sheet and document(s))*. Name of Assignee: ______________________
16. ☐ 37 CFR 3.73(c) Statement *(when there is an Assignee)*.

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17. ☑ Other items or information:

International Search Report and Written Opinion of the ISA, Reply to the Written Opinion of the ISA, and International Preliminary Report on Patentability including annexes.

The following fees have been submitted.	CALCULATIONS	PTO USE ONLY
18. ☑ Basic national fee (37 CFR 1.492(a)) **$280**	$ 280.00	
19. ☑ Examination fee (37 CFR 1.492(c)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) .... **$0** All other situations **$720**	$ 720.00	
20. ☑ Search fee (37 CFR 1.492(b)) If the written opinion prepared by ISA/US or the international preliminary examination report prepared by IPEA/US indicates all claims satisfy provisions of PCT Article 33(1)-(4) .... **$0** Search fee (37 CFR 1.445(a)(2)) has been paid on the international application to the USPTO as an International Searching Authority ....**$120** International Search Report prepared by an ISA other than the US and provided to the Office or previously communicated to the US by the IB ....**$480** All other situations **$600**	480.00 $	
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CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	20 - 20 =	0	x **$80**	$ 0	
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MULTIPLE DEPENDENT CLAIM(S) (if applicable)			+ **$780**	$ 0	

Processing fee of **$140.00** for furnishing the English translation later than 30 months from the earliest claimed priority date (37 CFR 1.492(i)). **+**	$ 0	
TOTAL OF ABOVE CALCULATIONS =	$ 1,480.00	
☐ **Applicant asserts small entity status.** See 37 CFR 1.27. Fees above are reduced by ½.		
☐ **Applicant certifies micro entity status.** See 37 CFR 1.29. Fees above are reduced by ¼. Applicant must attach form PTO/SB/15A or B or equivalent.		
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(54) Title: ADHESIVE SYSTEM

(57) Abstract: The invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous polymer dispersion; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin. The invention further concerns a method of producing a wood based product, wood based products obtainable thereby and use of the adhesive system.

ADHESIVE SYSTEM

The invention relates to an adhesive system, use thereof, a method of producing a wood based product and products obtainable thereby.

Adhesive systems comprising amino resins are widely used in the production of wood based products. Examples of amino resins include urea-formaldehyde (UF), melamine-formaldehyde (MF) and urea-melamine-formaldehyde (MUF). Examples of wood based products include composite products comprising layers glued together such as plywood, laminated flooring products and veneered products used in, e.g., furniture.

Upon curing an amino resin, formaldehyde may be released both during the manufacture of wood based products and also later during use of the products. Formaldehyde emission to indoor air is a major concern for health reasons.

US 4409293 discloses that formaldehyde emissions from UF resins can be decreased by using a resin having a formaldehyde to urea molar ratio from 1.0:1 to 1.2:1.

However, using a resin with too low formaldehyde to urea ratio requires high press temperature and/or long press times in order to achieve satisfactory bonding. High temperature increases the energy consumption while long press time reduces the production capacity. Further, too high press temperature is not suitable for many kinds of products.

WO 2007/040410 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

However, although addition of significant amounts of urea reduces the formaldehyde emissions, it also leads to longer press times being required.

It is an object of the invention to provide an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

One aspect of the present invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous dispersion of at least one polymer; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

A further aspect of the invention concerns a method of producing a wood based product, comprising applying an adhesive system of the invention onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

Still a further aspect of the invention concerns a wood based product obtainable by the method of the invention. Such a product comprises comprising wooden material and cured adhesive.

Still a further aspect of the invention concerns use of an adhesive system of the invention for joining one or more pieces of a wooden material with one or more further pieces of a material.

The term “adhesive system“ as used herein refers to a combination of components which function as and is intended to be used together as an adhesive. The components may be present in the same adhesive composition comprising all the components necessary for its function as an adhesive or in separate compositions, such as an adhesive composition and a hardener, functioning as an adhesive when combined. Such separate compositions may be mixed shortly before application to the surfaces to be joined or be applied separately to the surfaces. In the present invention, the resin component and the hardener component are usually kept separated and not mixed until during or shortly before use. The aqueous polymer dispersion may be included in the hardener component but may also be a separate component that is mixed with the other components during or shortly before use. The adhesive system of the invention is particularly useful for joining pieces of wooden materials.

The term “amino resin” as used herein refers to a condensation product of formaldehyde and at least one compound carrying $–NH_2$ or $–NH$ groups. Such compounds include, for example, urea and melamine and resins include, for example, UF, MF and MUF resins.

The term “urea based amino resin” as used herein refers to amino resins, such as UF and MUF, in which urea constitutes from 75 to 100 wt% for example from 90 to 100 wt% or from 95 to 100% of said at least one compound carrying -NH_2 or -NH groups. However, also other compounds comprising reactive nitrogen may be included at the preparation of the resins, such as NH_3 or hexamine.

MUF resins may be based on a mixture of a UF resin and a MUF resin prepared separately, but may also be a co-condensation product of melamine, urea and formaldehyde. Urea based amino resins of the kinds mentioned above are commercially available at various ratios between the constituents, for example between melamine and urea and between the amine and formaldehyde.

The term “F/NH_2 ratio” is commonly used in the art of amino resins for characterising the amount of formaldehyde compared to the amount of reactive nitrogen in the raw materials used for preparing the resin. The term as used herein refers to the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, such as in the ring structure of melamine, if used. Thus, even if written as “NH_2” most of the nitrogen in the final resin is not in the form of NH_2 and does further include also nitrogen originating from optional other reactive nitrogen containing groups in the raw materials of the resin. Further, most of the formaldehyde is reacted in the final resin, but the amount used can be determined after hydrolysing the resin. If urea is the only nitrogen containing compound used for the resin, the F/NH_2 is equal to ½ of the F/U ratio. The urea based amino resin of the present invention has an F/NH_2 molar ratio from 0.3 to 0.65, for example from 0.4 to 0.6 or from 0.45 to 0.6. The F/NH_2 molar ratio may also be from 0.45 to 0.55 or from 0.45 to 0.5.

The term dry content as used herein refers to the content of anything in the adhesive system or a component thereof not being water. The entire adhesive system may, for example, comprise from 20 to 70 or from 40 to 60 wt% water.

The term wooden material as used herein refers not only to solid wood, but also to materials such as fibre-, chip-, and particleboard materials. The surfaces to be joined may be of the same or different types of materials. The pieces of wooden material can be any type and form such as chips, fibres, sheets, laminas, veneers, board products etc. The invention is particularly favourable for joining veneers onto a substrate, such as a board

material like any one of such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board.

The resin component comprises a urea based amino resin and may, for example, be an aqueous solution thereof. The resin component, including any water therein, may, for example, comprise from 50 to 90 wt% or from 65 to 80 wt% of urea based amino resin.

The hardener component comprises at least one acid, acid generating salt or acidic salt and may, for example, be an aqueous solution thereof. Examples of acids include organic acids like carboxylic acids as well as inorganic acids. Specific examples of acids include formic acid, acetic acid, maleic acid, citric acid, glycolic acid, lactic acid, malic acid, tartaric acid, phosphoric acid, hydrochloric acid, sulphamic acid, sulphonic acid and para-toluene sulphonic acid. Examples of acid generating salts include ammonium salts such as ammonium chloride, ammonium sulphate and ammonium phosphate, as well as organic salts like ethylene diamine salts. Examples of acidic salts include metal salts such as acidic aluminium, zirconium, zink, magnesium and calcium salts, for example those that are water soluble of chloride, nitrate and sulphate, particularly aluminium salts like aluminium chloride, aluminium nitrate and aluminium sulphate. The concentration of acid, acid generating salt or acidic salt in the hardener component may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt%. The hardener component may further comprise additives used in the art such as fillers like kaolin, chalc, wood flour, coconut meal etc. Other possible additives include, for example, cellulose derivates like carboxymethyl cellulose (CMC) or hydroxyethyl cellulose (HEC). The dry content of the hardener component may, for example, be from 20 to 80 wt% or from 35 to 60 wt%.

The aqueous polymer dispersion comprise finely dispersed particle of at least one polymer, for example in an amount from 20 to80 wt% or from 30 to 70 wt% polymer in the aqueous dispersion. The polymer may, for example, be at least one synthetic polymer, such as homo- and co-polymers made from ethylenically unsaturated monomers like vinyl monomers. Examples of polymers include homo- or co-polymers of vinylacetate, homo or co-polymers of esters of (meth)acrylic acid, homo-or co-polymers of (meth)acrylamide, homo- or co-polymers of (meth)acrylic acid or homo- or co-polymers of vinyl alcohol. Further examples include and styrene-butadiene co-polymers. More specific examples of polymers include polyvinyl acetate (PVAc), polyethylene vinylacetate (EVA), co-polymers of vinylchloride and vinylacetate or ethylene vinylacetate, polyethylene-acrylic acid (PEAA), ethylene methyl acrylate copolymer (EMA), polyethyl methacrylate (PEMA), co-

polymers of vinylacetate and other esters, such as alkyl esters of (meth)acrylic acid, styrene acrylate co-polymers, and styrene-butadiene rubber (SBR). Further examples of polymers include polyurethane. Particularly useful polymers include at least one of PVAc and EVA, especially EVA. Many polymers useful for the invention are commercially available as aqueous dispersions or solutions. The polymers can also be prepared by general methods known to those skilled in the art.

The term "(meth)acryl" as used herein refers to both acryl and methacryl equally. For example, (meth)acrylate refers to any of acrylate or methacrylate while (meth)acrylic acid refers to any of acrylic acid or methacrylic acid.

In some embodiments the polymer is functionalised, i.e. comprises functional groups. Such groups include, for example, at least one of carboxylic acid, anhydrides thereof, N-alkylol, N-alkoxymethyl or glycidyl groups. Such groups may, for example be incorporated into the polymer by copolymerising at least one monomer comprising at least one such group with the other monomers. Examples of such monomers include acrylic acid, methacrylic acid, crotonic acid, isocrotonic acid, itaconic acid, itaconic anhydride, maleic acid, maleic anhydride, fumaric acid N-alkylol (meth)acrylamides such as N-methylol (meth)acrylamide and N-(alkoxymethyl) (meth)acrylates such as N-(butoxymethyl) (meth)acrylamide or N-(iso-butoxymethyl) (meth)acrylamide. However, the polymer may also be free from such monomers and particularly from monomers comprising groups that may release formaldehyde like N-methylol acrylamide.

Polymers mentioned herein, such a PVAc, refers both to functionalised and non-functionalised polymers, unless otherwise specified.

The average particle diameter of the dispersed polymer may, for example, be from 0.05 to 10 µm or from 0.1 to 5 µm. The weight average molecular weight M_w of the polymer may, for example, be from 100 000 to 4 000 000 or from 350 000 to 2 000 000.

In some embodiments the aqueous polymer dispersion is a separate component, for example comprising from 20 to 80 wt% or from 35 to 65 wt% of dispersed polymer particles. Such a separate component may be mixed with the hardener component and/or the resin component during or shortly before use of the adhesive system.

In some embodiments the aqueous polymer dispersion is included in the hardener component. The hardener component may then comprise at least one acid, acid generating salt or acidic salt as described above, usually dissolved in the aqueous phase, and dispersed polymer particles as described above. Such a hardener component may, for example, comprise from 0.1 to 10 wt% or from 1 to 5 wt% of acid, acid generating salt or acidic salt and from 20 to 80 wt% or from 35 to 65 of dispersed polymer particles. Examples of useful hardener components include those described in WO2001/070898, EP 0501174 and WO 2002/068178.

In some embodiments part of the polymer dispersion is a separate component and part of the dispersion is included in the hardener component.

The urea based amino resin usually comprise some free urea i.e. non-reacted urea, for example from 1 to 50 wt% or from 10 to 40 wt%, particularly from 15 to 35 wt% urea based on dry resin. However, in addition to the urea in the resin, the adhesive system of the invention comprises no or less than 0.9 wt% urea, for example less than 0.7 wt% urea or less than 0.5 wt% urea, particularly less than 0.3 wt% urea or less than 0.1 wt% urea, based on the total weight of the entire adhesive system.

The adhesive system is preferably free from or comprise less than 10 wt% of phenolic resin based on the amount of urea based amino resin, particularly less than 5 wt%, or less than 1 weight%.

Various ratios between the components in the adhesive system may be used. The amount of acid, acid generating salt and acidic salt in the adhesive system may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt% of the amount of dry urea based amino resin. Further, the weight ratio of dry urea based amino resin to dry polymer in the adhesive system may, for example, be from 45:1 to 1:15, particularly from 15:1 to 1:7 or from 5:1 to 1:3.

An adhesive system of the invention may further comprise additives such as polyvinyl alcohol (PVA), surfactants, emulsifiers, protective colloids, preservatives, antifoaming agents, viscosity adjusting agents; fillers such as kaolin or calcium carbonate, protein, starch, coalescing agents such as at least one of butyl di(ethylene)glycol acetate, diethyleneglycol monobutyl ether, diethyleneglycol monomethyl ether, diethyleneglycol dibensoate, dipropyleneglycol dibensoate, propylenecarbonate and dimethyl esters of glutarate, adipate or succinate, and other additives known to be suitable for use in wood adhesive formulations, including combinations thereof. Such additives may be included in any of the components, such as in at least one of the resin component or the hardener component.

In a method of the invention the resin component and the hardener component of the adhesive system are applied to at least one surface of one or more pieces of a wooden material, either separately or after being mixed shortly before application, for example from 30 seconds to 8 hours or from 1 to 30 minutes before application. When the components are applied separately, they may be applied to the same or to two different surfaces to be joined. After application of the adhesive system, the pieces to be joined are pressed together. The pressing time depends on the wood based product intended to be produced and may, for example, be from 5 seconds to 15 minutes, particularly from10 seconds to 10 minutes or from 20 seconds to 3 minutes. Also the temperature of the press depends on the product to be produced and may, for example, be from 20 to 180°C, preferably from 40 to 130°C or from 50 to 100°C.

The pieces of wooden material may be joined to other pieces of the same or different kind of wooden material or to non-wooden material like plastics or paper, for example in foiling applications.

Some embodiments of a method of the invention comprise applying the adhesive system onto a sheet-like material, and joining it with a further sheet-like material. The term sheet-like material as used herein refers to materials having dimensions in either the length or width directions, or both, that are much greater than the dimension of the material in the thickness direction; exemplary of sheet-like materials include lamellae, boards, veneer, and the like. For example, it is possible to make products by form pressing or to make products in which two or more different kinds of wood are joined, which is common in, for example, parquet flooring.

Some embodiments of the invention comprise applying the adhesive system onto a wooden board material, such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board, and joining the wooden material with another kind of material such as foils of paper or plastic materials.

A wood based product of the invention may, for instance, be a laminated or veneered material, such as laminated flooring, veneered flooring such as parquet flooring, a veneered furniture material, plywood (including curved plywood), wall panels, roofing panels, laminated beams.

The invention is further illustrated by means of the following non-limiting examples. Unless otherwise stated, parts and percentages refer to parts by weight and percent by weight, respectively.

Example 1

Three UF resins with different F/NH_2 were tested with four different hardeners.
Resin A: Molar ratio $F/NH_2 = 0.6$; dry content 66 wt%
Resin B: Molar ratio $F/NH_2 = 0.5$ dry content 71 wt%
Resin C: Molar ratio $F/NH_2 = 0.45$ dry content 70 wt%

The compositions of Hardeners 1-3 are shown in Table 1 below:

Table 1. Composition of Hardeners 1-3.

Ingredient	Hardener 1	Hardener 2	Hardener 3
Aqueous 55% EVA dispersion Vinnapas™ EP441	84.5%		
Aqueous 52% PVAc dispersion Vinac™ DPN-36		84.4%	
Aqueous 60% PVAc dispersion Mowilith™ DHSS3			78.6%
Aqueous $AlCl_3$ (28%)	15.3%	15.4%	15.3%
Water			5.9%
Other (colour, defoamer)	0.2%	0.2%	0.2%
Total concentration $AlCl_3$	4.3%	4.3%	4.3%
Total dry content	50.7%	48.2%	51.5%

Hardener 4 is based on WO 2007/040410 and is a mixture of Hardener I in Table 2 therein and Modifier 2 in Table 3 therein. Thus, a first composition was prepared from 4.0% aluminium chloride-6-hydrate, 4.0% mono ammonium phosphate, 2.2% polypropylene glycol, 37.4% resorcinol, 0.2% defoamer and colour, 0.45% xanthan gum, 5.0% lactic acid and 46.75% water. Further, a second composition was prepared from 65.9% Vinac DPN-36, 21.6% urea and 12.5% water. Then 13.3 parts of the first composition was mixed with 18.5 parts of the second composition. Using 31.8 parts of Hardener 4 with 100 parts UF resin thus corresponds to Mixture 6 in Table 3 of WO 2007/040410.

A press time study was performed with various combinations of the three resins A, B and C and the Hardeners 1-3. As a comparison trials were also made with Hardener 1 + 6% urea (referred to as 1U).

In the study pieces of 0.6 mm beech veneer were glued onto a particle board and pressed in a carver press with 5 x 0.6 mm pieces beech veneer creating a 3 mm distance to the press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C) and the strength of the bonds were evaluated when the glued constructions had reached room temperature (referred to as cold). The veneer was pulled off from the particle board by hand and the amount of fibre tear from the board on the veneer was estimated. Normally at least 80% fibre tear cold is required for passing the test, but lower values can be acceptable if the bond is strong. The press time refers to the shortest press time that could be used and still achieving sufficient bond strength for passing the test. The press times in minutes and seconds for the different combinations are shown in Table 2 below:

Table 2. Press times

Resin	Hardener	Ratio	Press time	Amount urea in the system$^{1)}$
A	1	100:50	1'30"	
A	1	100:75	1'15"	
A	1	100:100	1'	
A	2	100:50	1'30"	
A	2	100:75	1'15"	
A	2	100:100	1'	
A	3	100:50	1'30"	
A	3	100:75	1'15"	
A	3	100:100	1'	
A	1U	100:50	2'30"	2%
A	1U	100:75	2'30"	2.6%
A	1U	100:100	2'30"	3%
A	4	100:31.8	Did not pass	3%

Resin	Hardener	Ratio	Press time	Amount urea in the system[1)]
B	1	100:50	4'	
B	1	100:75	2'30"	
B	1	100:100	2'30"	
B	2	100:50	4'	
B	2	100:75	2'30"	
B	2	100:100	2'30"	
B	3	100:50	3'30"	
B	3	100:75	2'30"	
B	3	100:100	2'30"	
B	1U	100:50	7'	2%
B	1U	100:75	4'	2.6%
B	1U	100:100	2'30"	3%
B	4	100:31.8	Did not pass	3%
C	1	100:50	6'	
C	1	100:75	4'30"	
C	1	100:100	3'	
C	2	100:50	6'	
C	2	100:75	5'	
C	2	100:100	4'	
C	3	100:50	6'	
C	3	100:75	5'	
C	3	100:100	3'	
C	1U	100:50	10'	2%
C	1U	100:75	6'	2.6%
C	1U	100:100	6'	3%
C	4	100:31.8	Did not pass	3%
C	4	100:63.6	Did not pass'	5%

1) Refers to urea in addition to what may be present in the UF resin.

It appears that addition of urea increased the press time. Further, Hardener 4 could not be used at all for gluing with resins B and C having the lowest F/NH_2 ratio.

<u>Example 2</u>

In order to further investigate the differences between the hardeners additional pressings were performed with resin A. The ratio glue/hardener was 100:100 and press times were fixed to 20 and 30 seconds, respectively. The material used was 0.6 mm birch veneer on a HDF board in a carver press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C). The quality of the glue line was evaluated by estimation of bond strength when the glued construction had reached room temperature. The veneer was pulled off from the HDF by hand and the amount of fibre tear from the board on the veneer was estimated.

Table 3. Fibre tear

Resin	Hardener	Ratio	Press time	Fibre tear	Amount Urea in the system[1)]
A	1	100:100	20"	80%	
A	1	100:100	30"	80%	
A	2	100:100	20"	70%	
A	2	100:100	30"	60%	
A	3	100:100	20"	60%	
A	3	100:100	30"	50%	
A	1U	100:100	20"	30%	3%
A	1U	100:100	30"	50%	3%

[1)] Refers to urea in addition to what may be present in the UF resin.

It appears that Hardener comprising EVA gave the best result, except when urea was added.

Example 3

The formaldehyde emission for some combinations were evaluated according to the standard JAS MAFF 233 (Pressing temperature: 90°C; Pressure: 0.8 MPa; Material: 10 beech veneers 1.5 mm; Glue spread 160 g/cm3; Pressing times 8, 10 or 12 minutes). The results are shown in Table 4 below:

Table 4. Formaldehyde emissions

Resin	Hardener	Ratio	Emission (mg/l)
A	1	100:40	0.7
B	1	100:40	0.2
C	1	100:40	0.1
A	2	100:40	0.9
B	2	100:40	0.2
C	2	100:40	0.1
A	3	100:40	1.1
B	3	100:40	0.2
C	3	100:40	0.1
A	4	100:31.8	0.2

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous dispersion of at least one polymer;

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises at least one homo- or co-polymer made from ethylenically unsaturated monomers.

7. Adhesive system as claimed in claim 6, wherein the at least one polymer comprises at least one homo- or co-polymers of vinylacetate.

8. Adhesive system as claimed in claim 7, wherein the at least one polymer comprises at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA).

9. Adhesive system as claimed in claim 8, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

10. Adhesive system as claimed in any one of the claims 1-9, wherein the hardener component comprise at least one aluminium salt.

11. Adhesive system as claimed in any one of the claims 1-10, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

12. Adhesive system as claimed in any one of the claims 1-11, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

13. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-12 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

14. Wood based product obtainable by the method according to claim 13.

15. Use of an adhesive system according to any one of the claims 1-12 for joining one or more pieces of a wooden material with one or more further pieces of a material.

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063766

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08G8/10 C09J161/02 C09J161/28
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C08G C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, BEILSTEIN Data, CHEM ABS Data, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/040410 A1 (DYNEA OY [FI]; PEDERSEN ASTRID [NO]; SANDBAKKEN PER OLAV [NO]) 12 April 2007 (2007-04-12) page 1 - page 16, line 11; claims 1-11; examples -----	1-5
X	WO 03/033610 A1 (AKZO NOBEL NV [NL]; CASCO PRODUCTS AB [SE]; PIRHONEN SALME [SE]; NASLI) 24 April 2003 (2003-04-24) page 1, line 3 - page 8, line 6; claims 1-23; examples -----	1-15
X	EP 1 136 537 A1 (AKZO NOBEL NV [NL]) 26 September 2001 (2001-09-26) paragraph [0001] - paragraph [0049]; claims 1-19; examples ----- -/--	1-15

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
31 July 2012	09/08/2012

Name and mailing address of the ISA/	Authorized officer
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2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063766

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 062 389 A1 (METHANOL CHEMIE NEDERLAND [NL]) 13 October 1982 (1982-10-13) page 1 - page 4, line 13; claims 1-10; examples -----	1-15
X	EP 0 025 245 A2 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 18 March 1981 (1981-03-18) page 1 - page 5, line 22; claims 1-10; examples -----	1-15
X	EP 0 107 260 A1 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 2 May 1984 (1984-05-02) page 1, line 1 - page 4, line 2; claims 1-10; examples -----	1-15

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/063766

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007040410 A1	12-04-2007	AT 556123 T	15-05-2012
		DK 1945729 T3	23-07-2012
		EP 1945729 A1	23-07-2008
		WO 2007040410 A1	12-04-2007
WO 03033610 A1	24-04-2003	AT 361963 T	15-06-2007
		AU 2002339806 B2	25-08-2005
		AU 2002339807 B2	25-08-2005
		BR 0213276 A	26-10-2004
		BR 0213277 A	26-10-2004
		CA 2463635 A1	24-04-2003
		CA 2463636 A1	24-04-2003
		CN 1568357 A	19-01-2005
		CN 1571823 A	26-01-2005
		DE 60220085 T2	10-01-2008
		DK 1448741 T3	10-09-2007
		EP 1448740 A1	25-08-2004
		EP 1448741 A1	25-08-2004
		ES 2286294 T3	01-12-2007
		HU 0401780 A2	29-11-2004
		HU 0401796 A2	28-12-2004
		JP 4537706 B2	08-09-2010
		JP 2005505677 A	24-02-2005
		JP 2005505678 A	24-02-2005
		MY 135503 A	30-04-2008
		NO 20042038 A	15-07-2004
		NO 20042039 A	13-07-2004
		NZ 531995 A	23-12-2005
		NZ 531996 A	28-10-2005
		SI 1448741 T1	31-12-2007
		UA 77985 C2	15-02-2007
		WO 03033609 A1	24-04-2003
		WO 03033610 A1	24-04-2003
EP 1136537 A1	26-09-2001	AT 9585 U1	15-12-2007
		AT 328979 T	15-06-2006
		AU 4293801 A	03-10-2001
		AU 2001242938 B2	28-10-2004
		BR 0109305 A	17-12-2002
		CA 2403362 A1	27-09-2001
		CN 1419593 A	21-05-2003
		DE 01915994 T1	23-06-2005
		DE 20122619 U1	28-09-2006
		DE 60120376 T2	07-12-2006
		DK 1268700 T3	02-10-2006
		EE 200200536 A	15-04-2004
		EP 1136537 A1	26-09-2001
		EP 1268700 A1	02-01-2003
		ES 2266175 T3	01-03-2007
		FI 7319 U1	30-11-2006
		JP 4439784 B2	24-03-2010
		JP 2003528203 A	24-09-2003
		NO 20024443 A	15-11-2002
		NZ 521208 A	30-05-2003
		PL 357806 A1	26-07-2004
		SI 1268700 T1	30-04-2007
		SK 13412002 A3	11-09-2003
		US RE40730 E1	09-06-2009

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/063766

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2001031825 A1	18-10-2001
		WO 0170898 A1	27-09-2001
EP 0062389 A1	13-10-1982	CA 1206655 A1	24-06-1986
		DE 3272092 D1	28-08-1986
		EP 0062389 A1	13-10-1982
		NL 8101700 A	01-11-1982
		US 4510278 A	09-04-1985
EP 0025245 A2	18-03-1981	CA 1166394 A1	24-04-1984
		DE 3068797 D1	06-09-1984
		DK 377180 A	12-03-1981
		EP 0025245 A2	18-03-1981
		FI 802829 A	12-03-1981
		NL 7906751 A	13-03-1981
		NO 802687 A	12-03-1981
		US 4362827 A	07-12-1982
EP 0107260 A1	02-05-1984	EP 0107260 A1	02-05-1984
		NL 8204144 A	16-05-1984
		NO 833915 A	30-04-1984

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	
DECLARATION	ATTORNEY'S DOCKET NO.

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter that is claimed and for which a patent is sought on the invention entitled **ADHESIVE SYSTEM**, the specification of which was filed as PCT International Patent Application No. **PCT/EP2012/063766** on **July 13, 2012.**

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 C.F.R. § 1.56, including for continuation-in-part applications, material information which became available between the filing date of the prior application and the national or PCT International filing date of the continuation-in-part application.

PRIOR FOREIGN APPLICATION(S)

I hereby claim foreign priority benefits under Title 35, United States Code, § 119(a)-(d) or §365(b) of any foreign application(s) for patent or inventor's certificate, or §365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below any foreign application for patent or inventor's certificate or PCT International application having a filing date before that of the application on which priority is claimed:

COUNTRY	APPLICATION NUMBER	DATE OF FILING (day, month, year)	DATE OF ISSUE (day, month, year)	PRIORITY CLAIMED UNDER 35 U.S.C. § 119
EP	**11174128.6**	**15 July 2011**		**YES**

PRIOR UNITED STATES APPLICATION(S)

I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below:

APPLICATION NUMBER	FILING DATE (day, month, year)
61/508,205	**15 July 2011**

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or §365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

APPLICATION NUMBER	FILING DATE (day, month, year)	STATUS (i.e. Patented, Pending, Abandoned)

SEND CORRESPONDENCE, AND DIRECT TELEPHONE CALLS TO:

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Customer No. 26646

I declare that all statements made herein of my own knowledge are true and all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under § 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

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Signature			**Date** 2013-12-16

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Signature	Salme Pirhonen		**Date** 2013-12-19

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Inventor(s) : Jenny ADRIAN MEREDITH, et al.

Serial No. : To Be Assigned

Filed : Herewith

For : **ADHESIVE SYSTEM**

Examiner : To Be Assigned

Art Unit : To Be Assigned

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P.O. Box 1450
Alexandria, VA 22313-1450

I hereby certify that this correspondence is being electronically transmitted to the United States Patent and Trademark Office via the Office electronic filing system on

Date: January 8, 2014

Signature: /Neil H. Benowitz/
Neil H. Benowitz

PRELIMINARY AMENDMENT

S I R:

Kindly amend the above-captioned application before examination, as set forth below.

Amendments to the Specification appear on page 2 of this paper.

Amendments to the Claims are reflected in the listing of claims which begins on page 3 of this paper.

Remarks begin on page 6 of this paper.

Amendments to the Specification:

Please insert the following new paragraph after the Title on page 1:

REFERENCE TO RELATED APPLICATIONS

This application is the U.S. National Phase of PCT/EP2012/063766, filed on July 13, 2012, and claims the benefit of EP Application No. 11174128.6, filed on July 15, 2011, and US Application No. 61/508,205, filed on July 15, 2011.

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

1-15. (cancelled).

16. (new) An adhesive system comprising
    a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups;
    b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
    c. an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) and poly ethylene vinylacetate (EVA);

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

17. (new) The adhesive system according to claim 16, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

18. (new) The adhesive system according to claim 17, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

19. (new) The adhesive system according to claim 16, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

20. (new) The adhesive system according to claim 19, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

21. (new) The adhesive system according to claim 16, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

22. (new) The adhesive system according to claim 16, wherein the hardener component comprise at least one aluminium salt.

23. (new) The adhesive system according to claim 16, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

24. (new) The adhesive system according to claim 16, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

25. (new) A method of producing a wood based product, comprising applying the adhesive system according to claim 16 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

26. (new) The adhesive system according to claim 18, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

27. (new) The adhesive system according to claim 26, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

28. (new) The adhesive system according to claim 18, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

29. (new) The adhesive system according to claim 19, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

30. (new) The adhesive system according to claim 18, wherein the hardener component comprise at least one aluminium salt.

31. (new) The adhesive system according to claim 21, wherein the hardener component comprise at least one aluminium salt.

32. (new) The adhesive system according to claim 19, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

33. (new) The adhesive system according to claim 21, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

34. (new) The adhesive system according to claim 19, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

35. (new) A method of producing a wood based product, comprising applying the adhesive system according to claim 33 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

REMARKS

The specification has been amended herein such that the first sentence of the specification reflects the benefit claim to International Application No. PCT/EP2012/063766 and of EP Application No. 11174128.6, and US Application No. 61/508,205. No new matter has been added herein by these amendments.

This Preliminary Amendment also cancels claims 1-15 and adds new claims 16-35 in the underlying PCT Application No. PCT/EP2012/063766. The amendments to the claims, *inter alia*, conform the claims to U.S. Patent and Trademark Office rules and do not add any new matter to the application.

The underlying PCT Application No. PCT/EP2012/063766 includes an International Search Report, mailed on August 9, 2012, a copy of which is included. The Search Report includes a list of documents that were considered by the Examiner in the underlying PCT application.

It is respectfully submitted that the subject matter of the present application is new, non-obvious and useful. Prompt consideration and allowance of the application are respectfully requested.

Respectfully submitted,
KENYON & KENYON LLP

Dated: January 8, 2014

By: /Kevin T. Godlewski/
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Application Data Sheet 37 CFR 1.76		Attorney Docket Number	13877/48501
		Application Number	
Title of Invention	ADHESIVE SYSTEM		

The application data sheet is part of the provisional or nonprovisional application for which it is being submitted. The following form contains the bibliographic data arranged in a format specified by the United States Patent and Trademark Office as outlined in 37 CFR 1.76.
This document may be completed electronically and submitted to the Office in electronic format using the Electronic Filing System (EFS) or the document may be printed and included in a paper filed application.

Secrecy Order 37 CFR 5.2

☐ Portions or all of the application associated with this Application Data Sheet may fall under a Secrecy Order pursuant to 37 CFR 5.2 (Paper filers only. Applications that fall under Secrecy Order may not be filed electronically.)

Applicant Information:

Applicant 1

Applicant Authority ● Inventor	○ Legal Representative under 35 U.S.C. 117		○ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
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Applicant 2

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Citizenship under 37 CFR 1.41(b) i	SE		

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City	Stockholm	**State/Province**	
Postal Code	S-120 64	**Country** i	SE

Applicant 3

Applicant Authority ● Inventor	○ Legal Representative under 35 U.S.C. 117		○ Party of Interest under 35 U.S.C. 118	
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**
	Eugeniusz		ABRAM	

Residence Information (Select One) ○ US Residency ● Non US Residency ○ Active US Military Service

City	Solna	**Country Of Residence** i	SE

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
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Application Data Sheet 37 CFR 1.76	Attorney Docket Number	13877/48501
	Application Number	
Title of Invention	ADHESIVE SYSTEM	

Citizenship under 37 CFR 1.41(b)	PL		
Mailing Address of Applicant:			
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Address 2			
City	Solna	**State/Province**	
Postal Code	S-169 58	**Country**	SE

Applicant 4

Applicant Authority	● Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118		
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**	
	Benyahia		NASLI-BAKIR		
Residence Information (Select One)	○ US Residency	● Non US Residency	○ Active US Military Service		
City	Saltsjö-boo	**Country Of Residence**	SE		
Citizenship under 37 CFR 1.41(b)	SE				
Mailing Address of Applicant:					
Address 1	Fältspatsvägen 24 B				
Address 2					
City	Saltsjö-boo	**State/Province**			
Postal Code	S-132 35	**Country**	SE		

Applicant 5

Applicant Authority	● Inventor	○ Legal Representative under 35 U.S.C. 117	○ Party of Interest under 35 U.S.C. 118		
Prefix	**Given Name**	**Middle Name**	**Family Name**	**Suffix**	
	Salme		PIRHONEN		
Residence Information (Select One)	○ US Residency	● Non US Residency	○ Active US Military Service		
City	Sollentuna	**Country Of Residence**	SE		
Citizenship under 37 CFR 1.41(b)	FI				
Mailing Address of Applicant:					
Address 1	Skinnaråsvägen 30				
Address 2					
City	Sollentuna	**State/Province**			
Postal Code	S-192 75	**Country**	SE		

All Inventors Must Be Listed - Additional Inventor Information blocks may be generated within this form by selecting the **Add** button. Add

Correspondence Information:

Enter either Customer Number or complete the Correspondence Information section below. For further information see 37 CFR 1.33(a).

☐ **An Address is being provided for the correspondence Information of this application.**

Customer Number	26646

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	13877/48501
	Application Number	
Title of Invention	ADHESIVE SYSTEM	

Email Address		Add Email Remove Email

Application Information:

Title of the Invention	ADHESIVE SYSTEM		
Attorney Docket Number	13877/48501	**Small Entity Status Claimed**	☐
Application Type	Nonprovisional		
Subject Matter	Utility		
Suggested Class (if any)		**Sub Class (if any)**	
Suggested Technology Center (if any)			
Total Number of Drawing Sheets (if any)		**Suggested Figure for Publication (if any)**	

Publication Information:

☐ Request Early Publication (Fee required at time of Request 37 CFR 1.219)

☐ **Request Not to Publish.** I hereby request that the attached application not be published under 35 U.S.C. 122(b) and certify that the invention disclosed in the attached application **has not and will not** be the subject of an application filed in another country, or under a multilateral international agreement, that requires publication at eighteen months after filing.

Representative Information:

Representative information should be provided for all practitioners having a power of attorney in the application. Providing this information in the Application Data Sheet does not constitute a power of attorney in the application (see 37 CFR 1.32).
Enter either Customer Number or complete the Representative Name section below. If both sections are completed the Customer Number will be used for the Representative Information during processing.

Please Select One:	● Customer Number	○ US Patent Practitioner	○ Limited Recognition (37 CFR 11.9)
Customer Number	26646		

Domestic Benefit/National Stage Information:

This section allows for the applicant to either claim benefit under 35 U.S.C. 119(e), 120, 121, or 365(c) or indicate National Stage entry from a PCT application. Providing this information in the application data sheet constitutes the specific reference required by 35 U.S.C. 119(e) or 120, and 37 CFR 1.78(a)(2) or CFR 1.78(a)(4), and need not otherwise be made part of the specification.

Prior Application Status	Pending		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
unassigned	a 371 of international	PCTEP2012063766	2012-07-13
Prior Application Status	Expired		Remove
Application Number	Continuity Type	Prior Application Number	Filing Date (YYYY-MM-DD)
PCTEP2012063766	non provisional of	61508205	2011-07-15

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	13877/48501
	Application Number	
Title of Invention	ADHESIVE SYSTEM	

Additional Domestic Benefit/National Stage Data may be generated within this form by selecting the **Add** button.

Foreign Priority Information:

This section allows for the applicant to claim benefit of foreign priority and to identify any prior foreign application for which priority is not claimed. Providing this information in the application data sheet constitutes the claim for priority as required by 35 U.S.C. 119(b) and 37 CFR 1.55(a).

Remove

Application Number	Country	Parent Filing Date (YYYY-MM-DD)	Priority Claimed
11174128.6	EP	2011-07-15	● Yes ○ No

Additional Foreign Priority Data may be generated within this form by selecting the **Add** button.

Assignee Information:

Providing this information in the application data sheet does not substitute for compliance with any requirement of part 3 of Title 37 of the CFR to have an assignment recorded in the Office.

Assignee 1

If the Assignee is an Organization check here. ☒

Organization Name	AKZO NOBEL COATINGS INTERNATIONAL B.V.		
Mailing Address Information:			
Address 1	VELPERWEG 76		
Address 2			
City	ARNHEM	**State/Province**	
Country	NL	Postal Code	NL-6824 BM
Phone Number		Fax Number	
Email Address			

Additional Assignee Data may be generated within this form by selecting the **Add** button.

Signature:

A signature of the applicant or representative is required in accordance with 37 CFR 1.33 and 10.18. Please see 37 CFR 1.4(d) for the form of the signature.

Signature	/Kevin T. Godlewski/			Date (YYYY-MM-DD)	2014-01-08
First Name	Kevin	Last Name	Godlewski	Registration Number	47598

PTO/SB/14 (11-08)
Approved for use through 01/31/2014. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

Application Data Sheet 37 CFR 1.76	Attorney Docket Number	13877/48501
	Application Number	

Title of Invention	ADHESIVE SYSTEM

POWER OF ATTORNEY TO PROSECUTE APPLICATION BEFORE THE UNITED STATES PATENT AND TRADEMARK OFFICE

AKZO NOBEL COATINGS INTERNATIONAL B.V., hereby appoints the following practitioner(s) associated with: **Customer Number 26646**

as its attorney(s) to represent it before the United States Patent and Trademark Office in connection with any and all patent applications assigned to it according to the assignment records of the United States Patent and Trademark Office or assignment documents attached to this paper in accordance with 37 C. F. R. § 3.73(b).

Please direct all correspondence for the application identified in the attached statement under 37 C. F. R. § 3.73(b) to:

Patrick J. Birde
KENYON & KENYON LLP
One Broadway
New York, NY 10004
Telephone: (212) 425-7200
Facsimile: (212) 425-5288
Customer No: 26646

A copy of this form, together with a statement under 37 C. F. R. § 3.73(b) (Form PTO/SB/96 or equivalent) is required to be filed in each application in which this form is used. The statement under 37 C. F. R. § 3.73(b) may be completed by one of the practitioners appointed in this form if the appointed practitioner is authorized to act on behalf of the assignee, and must identify the application in which this Power of Attorney is to be filed.

The undersigned, whose title is supplied below, is authorized to act on behalf of **AKZO NOBEL COATINGS INTERNATIONAL B.V.**

AKZO NOBEL COATINGS INTERNATIONAL B.V.
Velperweg 76
NL-6824 BM Arnhem
The Netherlands

Signature	Signature
Petrus Hubertus van Deursen	Adriaan Jacobus de Vries
Name	Name
Authorized Signatory	Authorized Signatory
Title	Title
April 5, 2013	April 5, 2013
Date	Date

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE

STATEMENT UNDER 37 C.F.R. 3.73(b)		Docket Number: 13877/48501	
Application Number Herewith	International Filing Date July 13, 2012	Examiner To be assigned	Confirmation No. To be assigned
Invention Title **ADHESIVE SYSTEM**		Inventor(s) ADRIAN MEREDITH et al.	

Address to:
Commissioner for Patents
P.O. Box 1450
Alexandra, VA 22313-1450

AKZO NOBEL COATINGS INTERNATIONAL B.V., a corporation, states that it is the assignee of the entire right, title and interest in the patent application identified above by virtue of:

[X] An assignment from the inventor(s) of the patent application identified above. The assignment was recorded on ____________ in the United States Patent and Trademark Office at Reel ________, Frame _______, or **for which a copy thereof is attached.**

OR

[ ] A chain of title from the inventor of the patent application identified above, to the current assignee as shown below:

1. From__________ to ________. The document was recorded in the United States Patent and Trademark Office at Reel ________, Frame _______.

[ ] Additional documents in the chain of title are listed on a supplemental sheet.

[ ] Copies of assignments or other documents in the chain of title are attached.

[X] As required by 37 CFR 3.73(b)(1)(i), the documentary evidence of the chain of title from the original owner to the assignee was, or concurrently is being, submitted for recordation pursuant to 37 CFR 3.11.

The undersigned is authorized to act on the behalf of the assignee.

Signature: /Kevin T. Godlewski/ Date: January 8, 2014
Kevin T. Godlewski (Reg. No.: 47,598)

KENYON & KENYON LLP
One Broadway
New York, N.Y. 10004
(212) 425-7200 (telephone)
(212) 425-5288 (facsimile)

CUSTOMER NO. 26646

ASSIGNMENT

WHEREAS, we,

Jenny ADRIAN MEREDITH
Tavelsjövägen 18
S-120 59 Årsta
Sweden
Citizenship: Swedish

Anna Kristina FURBERG
Babordsgatan 8
S-120 64 Stockholm
Sweden
Citizenship: Swedish

Eugeniusz ABRAM
Vasavägen 29
S-169 58 Solna
Sweden
Citizenship: Polish

Benyahia NASLI-BAKIR
Fältspatsvägen 24 B
S-132 35 Saltsjö-Boo
Sweden
Citizenship: Swedish

and

Salme PIRHONEN
Skinnaråsvägen 30
S-192 75 Sollentuna
Sweden
Citizenship: Finnish

have made inventions and discoveries in **ADHESIVE SYSTEM,** for which an application for Letters Patent was filed as PCT International Patent Application No. **PCT/EP2012/063766** on **July 13, 2012**; and

WHEREAS **AKZO NOBEL COATINGS INTERNATIONAL B.V.**, having a place of business at **Velperweg 76, NL-6824 BM Arnhem, The Netherlands** and who, together with its successors and assigns, is hereinafter called Assignee, is desirous of acquiring the title, rights, benefits, and privileges hereinafter recited,

NOW, THEREFORE, for valuable consideration furnished by Assignee to us, receipt and sufficiency of which we hereby acknowledge, we hereby, without reservations:

1. Assign, transfer, and convey to Assignee the entire right, title, and interest in and to said inventions and discoveries, said application for Letters Patent of the United States of

America, any and all other applications for Letters Patent on said inventions and discoveries, including all divisional, renewal, substitute, and continuation applications based in whole or in part upon said inventions or discoveries, or upon said applications, and any and all Letters Patent, reissues, and extensions of Letters Patent granted for said inventions and discoveries or upon said applications, and every priority right that is or may be predicated upon or arise from said inventions, said discoveries, said applications, and said Letters Patent.

2. Authorize Assignee to file patent applications in any or all countries for any or all of said inventions and discoveries in our name or in the name of Assignee or otherwise as Assignee may deem advisable, under an International Convention or otherwise.

3. Authorize and request the Commissioner of Patents and Trademarks of the United States of America and the empowered officials of all other governments to issue or transfer all said Letters Patent to Assignee, as assignee of the entire right, title, and interest therein or otherwise as Assignee may direct.

4. Warrant that we have not conveyed to others any right, title, or interest in said inventions, discoveries, applications, or patents or any license to use the same or to make, use, or sell anything embodying or utilizing any of said inventions or discoveries; that we have good right to assign the same to Assignee without encumbrance; and that we are aware of no claim to the contrary.

5. Bind our heirs, legal representatives, and assigns, as well as ourselves, to do, upon Assignee's request and at Assignee's expense, but without additional consideration to us or them, all acts reasonably serving to assure that said inventions and discoveries, said patent applications, and said Letters Patent shall be held and enjoyed by Assignee as fully and entirely as the same could have been held and enjoyed by us, our heirs, legal representatives, and assigns if this assignment had not been made; and particularly to execute and deliver to Assignee all lawful application documents including petitions, specifications, and oaths, and all assignments, disclaimers, and lawful affidavits in form and substance as may be requested by Assignee; to communicate to Assignee all facts known to us relating to said inventions and discoveries or the history thereof; to furnish Assignee with any and all documents, photographs, models, samples, and other physical exhibits in our control or in the control of our heirs, legal representatives, or assigns which may be useful for establishing the facts of our conception, disclosure, and reduction to practice of said inventions and discoveries; and to testify to the same in any interference, arbitration, or litigation.

IN TESTIMONY WHEREOF, I have hereunto set my hand and seal this 12 day of december, 2013.

Jenny ADRIAN MEREDITH

IN TESTIMONY WHEREOF, I have hereunto set my hand and seal this 13 day of December, 2013.

Anna Kristina FURBERG

IN TESTIMONY WHEREOF, I have hereunto set my hand and seal this 11 day of DECEMBER, 2013.

Eugeniusz ABRAM

IN TESTIMONY WHEREOF, I have hereunto set my hand and seal this _11_ day of _DEC_, 2013.

Benyahia NASLI-BAKIR

IN TESTIMONY WHEREOF, I have hereunto set my hand and seal this 19 day of december, 2013.

Salme PIRHONEN

F02/J8N

PATENT COOPERATION TREATY

From the INTERNATIONAL SEARCHING AUTHORITY

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL SEARCH REPORT AND THE WRITTEN OPINION OF THE INTERNATIONAL SEARCHING AUTHORITY, OR THE DECLARATION

(PCT Rule 44.1)

To:
De Vries, Adriaan Jacob
AKZO NOBEL N.V.
Legal, IP & Compliance
Postbus 9300
NL-6800 SB Arnhem
PAYS-BAS

Term no: 163657
Call-up :
Exp.date:

	Date of mailing *(day/month/year)* 9 August 2012 (09-08-2012)
Applicant's or agent's file reference SWE11195WOP1	**FOR FURTHER ACTION** See paragraphs 1 and 4 below
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13 July 2012 (13-07-2012)
Applicant AKZO NOBEL COATINGS INTERNATIONAL B.V.	

1. ☒ The applicant is hereby notified that the international search report and the written opinion of the International Searching Authority have been established and are transmitted herewith.

   Filing of amendments and statement under Article 19:
   The applicant is entitled, if he so wishes, to amend the claims of the International Application (see Rule 46):

   When? The time limit for filing such amendments is normally two months from the date of transmittal of the International Search Report.

   Where? Directly to the International Bureau of WIPO, 34 chemin des Colombettes
   1211 Geneva 20, Switzerland, Fascimile No.: (41-22) 338.82.70

   For more detailed instructions, see ***PCT Applicant's Guide,*** International Phase, paragraphs 9.004 - 9.011.

2. ☐ The applicant is hereby notified that no international search report will be established and that the declaration under Article 17(2)(a) to that effect and the written opinion of the International Searching Authority are transmitted herewith.

3. ☐ **With regard to any protest** against payment of (an) additional fee(s) under Rule 40.2, the applicant is notified that:

   ☐ the protest together with the decision thereon has been transmitted to the International Bureau together with the applicant's request to forward the texts of both the protest and the decision thereon to the designated Offices.

   ☐ no decision has been made yet on the protest; the applicant will be notified as soon as a decision is made.

4. **Reminders**

   The applicant may submit comments on an informal basis on the written opinion of the International Searching Authority to the International Bureau. The International Bureau will send a copy of such comments to all designated Offices unless an international preliminary examination report has been or is to be established. Following the expiration of 30 months from the priority date, these comments will also be made available to the public.

   Shortly after the expiration of **18 months** from the priority date, the international application will be published by the International Bureau. If the applicant wishes to avoid or postpone publication, a notice of withdrawal of the international application, or of the priority claim, must reach the International Bureau before completion of the technical preparations for international publication (Rules 90*bis*.1 and 90*bis*.3).

   Within **19 months** from the priority date, but only in respect of some designated Offices, a demand for international preliminary examination must be filed if the applicant wishes to postpone the entry into the national phase **until 30 months** from the priority date (in some Offices even later); otherwise, the applicant must, **within 20 months** from the priority date, perform the prescribed acts for entry into the national phase before those designated Offices.

   In respect of other designated Offices, the time limit of **30 months** (or later) will apply even if no demand is filed within 19 months.

   For details about the applicable time limits, Office by Office, see www.wipo.int/pct/en/texts/time_limits.html and the *PCT Applicant's Guide*, National Chapters.

Name and mailing address of the International Searching Authority	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk Tel. (+31-70) 340-2040 Fax: (+31-70) 340-3016	BOON, Jan Tel: +31 (0)70 340-2873

Form PCT/ISA/220 (July 2010)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference SWE11195WOP1	**FOR FURTHER ACTION**	see Form PCT/ISA/220 as well as, where applicable, item 5 below.
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13/07/2012	(Earliest) Priority Date *(day/month/year)* 15/07/2011
Applicant AKZO NOBEL COATINGS INTERNATIONAL B.V.		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 5 sheets.

☒ It is also accompanied by a copy of each prior art document cited in this report.

1. **Basis of the report**
   a. With regard to the **language**, the international search was carried out on the basis of:
      ☒ the international application in the language in which it was filed
      ☐ a translation of the international application into __________, which is the language of a translation furnished for the purposes of international search (Rules 12.3(a) and 23.1(b))
   b. ☐ This international search report has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 43.6*bis*(a)).
   c. ☐ With regard to any **nucleotide and/or amino acid sequence** disclosed in the international application, see Box No. I.
2. ☐ **Certain claims were found unsearchable** (See Box No. II)
3. ☐ **Unity of invention is lacking** (see Box No III)
4. With regard to the **title**,
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established by this Authority to read as follows:
5. With regard to the **abstract**,
   ☒ the text is approved as submitted by the applicant
   ☐ the text has been established, according to Rule 38.2, by this Authority as it appears in Box No. IV. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority
6. With regard to the **drawings**,
   a. the figure of the **drawings** to be published with the abstract is Figure No. ______
      ☐ as suggested by the applicant
      ☐ as selected by this Authority, because the applicant failed to suggest a figure
      ☐ as selected by this Authority, because this figure better characterizes the invention
   b. ☐ none of the figures is to be published with the abstract

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063766

A. CLASSIFICATION OF SUBJECT MATTER
INV. C08G8/10 C09J161/02 C09J161/28
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C08G C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, BEILSTEIN Data, CHEM ABS Data, PAJ, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2007/040410 A1 (DYNEA OY [FI]; PEDERSEN ASTRID [NO]; SANDBAKKEN PER OLAV [NO]) 12 April 2007 (2007-04-12) page 1 - page 16, line 11; claims 1-11; examples	1-5
X	WO 03/033610 A1 (AKZO NOBEL NV [NL]; CASCO PRODUCTS AB [SE]; PIRHONEN SALME [SE]; NASLI) 24 April 2003 (2003-04-24) page 1, line 3 - page 8, line 6; claims 1-23; examples	1-15
X	EP 1 136 537 A1 (AKZO NOBEL NV [NL]) 26 September 2001 (2001-09-26) paragraph [0001] - paragraph [0049]; claims 1-19; examples	1-15

-/--

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search 31 July 2012	Date of mailing of the international search report 09/08/2012
Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Authorized officer Kiebooms, Rafaël

2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2012/063766

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 062 389 A1 (METHANOL CHEMIE NEDERLAND [NL]) 13 October 1982 (1982-10-13) page 1 - page 4, line 13; claims 1-10; examples -----	1-15
X	EP 0 025 245 A2 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 18 March 1981 (1981-03-18) page 1 - page 5, line 22; claims 1-10; examples -----	1-15
X	EP 0 107 260 A1 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 2 May 1984 (1984-05-02) page 1, line 1 - page 4, line 2; claims 1-10; examples -----	1-15

2

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/063766

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2007040410 A1	12-04-2007	AT 556123 T	15-05-2012
		DK 1945729 T3	23-07-2012
		EP 1945729 A1	23-07-2008
		WO 2007040410 A1	12-04-2007
WO 03033610 A1	24-04-2003	AT 361963 T	15-06-2007
		AU 2002339806 B2	25-08-2005
		AU 2002339807 B2	25-08-2005
		BR 0213276 A	26-10-2004
		BR 0213277 A	26-10-2004
		CA 2463635 A1	24-04-2003
		CA 2463636 A1	24-04-2003
		CN 1568357 A	19-01-2005
		CN 1571823 A	26-01-2005
		DE 60220085 T2	10-01-2008
		DK 1448741 T3	10-09-2007
		EP 1448740 A1	25-08-2004
		EP 1448741 A1	25-08-2004
		ES 2286294 T3	01-12-2007
		HU 0401780 A2	29-11-2004
		HU 0401796 A2	28-12-2004
		JP 4537706 B2	08-09-2010
		JP 2005505677 A	24-02-2005
		JP 2005505678 A	24-02-2005
		MY 135503 A	30-04-2008
		NO 20042038 A	15-07-2004
		NO 20042039 A	13-07-2004
		NZ 531995 A	23-12-2005
		NZ 531996 A	28-10-2005
		SI 1448741 T1	31-12-2007
		UA 77985 C2	15-02-2007
		WO 03033609 A1	24-04-2003
		WO 03033610 A1	24-04-2003
EP 1136537 A1	26-09-2001	AT 9585 U1	15-12-2007
		AT 328979 T	15-06-2006
		AU 4293801 A	03-10-2001
		AU 2001242938 B2	28-10-2004
		BR 0109305 A	17-12-2002
		CA 2403362 A1	27-09-2001
		CN 1419593 A	21-05-2003
		DE 01915994 T1	23-06-2005
		DE 20122619 U1	28-09-2006
		DE 60120376 T2	07-12-2006
		DK 1268700 T3	02-10-2006
		EE 200200536 A	15-04-2004
		EP 1136537 A1	26-09-2001
		EP 1268700 A1	02-01-2003
		ES 2266175 T3	01-03-2007
		FI 7319 U1	30-11-2006
		JP 4439784 B2	24-03-2010
		JP 2003528203 A	24-09-2003
		NO 20024443 A	15-11-2002
		NZ 521208 A	30-05-2003
		PL 357806 A1	26-07-2004
		SI 1268700 T1	30-04-2007
		SK 13412002 A3	11-09-2003
		US RE40730 E1	09-06-2009

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2012/063766

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
		US 2001031825 A1	18-10-2001
		WO 0170898 A1	27-09-2001
EP 0062389 A1	13-10-1982	CA 1206655 A1	24-06-1986
		DE 3272092 D1	28-08-1986
		EP 0062389 A1	13-10-1982
		NL 8101700 A	01-11-1982
		US 4510278 A	09-04-1985
EP 0025245 A2	18-03-1981	CA 1166394 A1	24-04-1984
		DE 3068797 D1	06-09-1984
		DK 377180 A	12-03-1981
		EP 0025245 A2	18-03-1981
		FI 802829 A	12-03-1981
		NL 7906751 A	13-03-1981
		NO 802687 A	12-03-1981
		US 4362827 A	07-12-1982
EP 0107260 A1	02-05-1984	EP 0107260 A1	02-05-1984
		NL 8204144 A	16-05-1984
		NO 833915 A	30-04-1984

Akzo Nobel N.V.
Legal , IP & Compliance

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www.akzonobel.com

AkzoNobel
Tomorrow's Answers Today

European Patent Office
Patentlaan 2
2280 HV RIJSWIJK
The Netherlands

April 18, 2013

Your ref: PCT/EP2012/063766
Our ref : SWE11195 WOP1

Re: International Patent Application No. PCT/EP2012/063766
Applicant: Akzo Nobel Coatings International B.V.

Dear Sirs,

Reference is made to the Written Opinion by the International Search Authority pursuant to Rule 43bis.1 PCT dated August 9, 2012 in respect of the above-identified application. Hereby by a new set of amended claims is submitted along with the following observations:

Amendments

Claim 1 has been amended by specifying the polymer to comprise at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA), which is supported by original claim 8. As a consequence, claims 6-8 have been deleted, while claims 9-15 have been renumbered and their dependencies brought into conformance with the new numbering.

Claim 1 has been further amended by including the definition of the F/NH_2 ratio as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, which is supported by the original description page 3, lines 13-15.

Clarity

The objections to the clarity have been overcome by the claim amendments.

The invention

The present invention relates to an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous dispersion of at least one polymer comprising at

least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA); wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

It has been found that the invention solves the problem of providing an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

Cited documents

D1 = WO 2007/040410

D2 = WO 03/033610

D3 = EP 1136537

D4 = EP 0062389

D5 = EP0025245

D6 = EP 0107260

Novelty

The International Search Authority has asserted that the claims lack novelty since all documents D1-D6 disclose urea based amino resins with the proper F/NH_2 ratio and a hardener compound. However, as will be shown below none of the documents do disclose all features of claim 1.

D1 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

The adhesive system of present claim 1 is distinguished from D1 by specifying that it comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

D2 discloses an adhesive system comprising a melaminic amino resin composition and a phenolic resin composition. The most preferred molar ratio aldehyde to amino compound is from about 0.7 to about 2. However, no preferred F/NH_2 is mentioned for resins predominantly based on urea.

The adhesive system of present claim 1 is distinguished from D2 by the combination of the claimed F/NH_2 ratio in a urea based amino resin (meaning that urea constitutes from 75 to 100 wt% of compounds carrying $-NH_2$ or -NH groups) and further in combination with a polymer dispersion comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA). Such a combination can only be arrived at by combining several lists and sub-ranges and does constitute a novel selection that is not unambiguously derivable from D2.

D3 discloses an adhesive system comprising an etherified amino resin. However, the F/NH_2 or any equivalent parameter is not disclosed and D3 cannot for this reason anticipate present claim 1.

D4-D6 all relate to UF resins with low F/NH_2 ratio to be used for particle board pressed at very high temperatures. However, none of D4-D6 discloses any

adhesive system comprising a dispersion of a polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA) as recited in present claim 1.

Accordingly, it is evident that none of the cited documents destroy the novelty of present claim 1.

Claims 2-12 include all limitations of claim 1 and are novel for the same reason.

Inventive step

The International Search Authority Examiner has not discussed the inventive step. Nevertheless, it is submitted that there is no ground for lack of inventive step.

Reasonably D1 is regarded as the closest prior art as has the highest amount of structural similarities as the present invention and also relate to the same problem.

As set out above, claim 1 of the present application is distinguished from D1 by specifying that the adhesive system comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

As shown in the Examples of the present application the claimed combination of the specified F/NH_2 and absence of urea gave both short press time and low emissions. On the other hand, with significant amounts or urea in the system, the press time required for giving sufficient bond strength was significantly longer. Furthermore, with systems based on Hardener 4 representing D1 (WO 2007/040410) sufficient bond strength for passing the test was not even reached. Thus, it is apparent that the distinguishing features do solve the problem.

A person skilled in the art starting from D1 and aiming at solving the problem of providing an adhesive system enabling both short press time and low emissions would not even consider omitting or lower the amount of urea since this would go against the entire teaching of D1. Furthermore, none of D2-D6 provides any incentive to go against this teaching in order to solve the above problem. Therefore, claim 1 of the present application cannot have been obvious to a person skilled in the art and does for this reason involve an inventive step.

Claims 2-12 include all limitations of claim 1 and are inventive for the same reason.

Final remarks

In view of the above submissions it is requested that a positive International Preliminary Examination Report is issued for the new claims filed. Should there be any outstanding objections, it is requested that the International Preliminary Examination Authority issues a further Written Opinion or, if such objections are believed to be possible to easily resolve, contacts the undersigned agent for a telephone discussion.

Yours faithfully,

Christer Jönsson
(Association No. 485 – G.A. 598670.8)

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA);

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

7. Adhesive system as claimed in any one of the claims 1-6, wherein the hardener component comprise at least one aluminium salt.

8. Adhesive system as claimed in any one of the claims 1-7, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

9. Adhesive system as claimed in any one of the claims 1-8, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

10. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-9 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

11. Wood based product obtainable by the method according to claim 10.

12. Use of an adhesive system according to any one of the claims 1-9 for joining one or more pieces of a wooden material with one or more further pieces of a material.

PATENT COOPERATION TREATY

From the
INTERNATIONAL PRELIMINARY EXAMINING AUTHORITY

To:

Akzo Nobel IP Department
Velperweg 76
NL-6824 BM Arnhem
PAYS-BAS

PCT

NOTIFICATION OF TRANSMITTAL OF THE INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(PCT Rule 71.1)

Date of mailing *(day/month/year)* 09.09.2013

IMPORTANT NOTIFICATION

Applicant's or agent's file reference SWE11195WOP1		
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13.07.2012	Priority date *(day/month/year)* 15.07.2011
Applicant Akzo Nobel Coatings International B.V.		

1. The applicant is hereby notified that this International Preliminary Examining Authority transmits herewith the international preliminary report on patentability and its annexes, if any, established on the international application.

2. A copy of the report and its annexes, if any, is being transmitted to the International Bureau for communication to all the elected Offices.

3. Where required by any of the elected Offices, the International Bureau will prepare an English translation of the report (but not of any annexes) and will transmit such translation to those Offices.

4. **REMINDER**

The applicant must enter the national phase before each elected Office by performing certain acts (filing translations and paying national fees) within 30 months from the priority date (or later in some Offices) (Article 39(1)) (see also the reminder sent by the International Bureau with Form PCT/IB/301).

Where a translation of the international application must be furnished to an elected Office, that translation must contain a translation of any annexes to the international preliminary report on patentability. It is the applicant's responsibility to prepare and furnish such translation directly to each elected Office concerned.

For further details on the applicable time limits and requirements of the elected Offices, see Volume II of the PCT Applicant's Guide.

The applicant's attention is drawn to Article 33(5), which provides that the criteria of novelty, inventive step and industrial applicability described in Article 33(2) to (4) merely serve the purposes of international preliminary examination and that "any Contracting State may apply additional or different criteria for the purposes of deciding whether, in that State, the claimed inventions is patentable or not" (see also Article 27(5)). Such additional criteria may relate, for example, to exemptions from patentability, requirements for enabling disclosure, clarity and support for the claims.

Name and mailing address of the international preliminary examining authority: European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016	Authorized Officer Dekker, Monique Tel. +31 70 340-4046

Form PCT/IPEA/416 (January 2004)

PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference SWE11195WOP1	**FOR FURTHER ACTION**	See Form PCT/IPEA/416
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13.07.2012	Priority date *(day/month/year)* 15.07.2011
International Patent Classification (IPC) or national classification and IPC INV. C08G8/10		
Applicant Akzo Nobel Coatings International B.V.		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 6 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:
   - a. ☒ *sent to the applicant and to the International Bureau)* a total of 5 sheets, as follows:
     - ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
     - ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.
   - b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s)) , containing a sequence listing, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see paragraph 3*bis* of Annex C of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☐	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand 19.04.2013	Date of completion of this report 09.09.2013
Name and mailing address of the international preliminary examining authority: European Patent Office P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk - Pays Bas Tel. +31 70 340 - 2040 Fax: +31 70 340 - 3016	Authorized officer Kiebooms, Rafaël Telephone No. +31 70 340-2425

Form PCT/IPEA/409 (Cover Sheet) (July 2010)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/EP2012/063766

Box No. I Basis of the report

1. With regard to the **language**, this report is based on

☒ the international application in the language in which it was filed

☐ a translation of the international application into , which is the language of a translation furnished for the purposes of:
  - ☐ international search (under Rules 12.3(a) and 23.1(b))
  - ☐ publication of the international application (under Rule 12.4(a))
  - ☐ international preliminary examination (under Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements*** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report)*:

Description, Pages

1-11	as originally filed	

Claims, Numbers

1-12	filed with the letter of	18-04-2013

☐ a sequence listing - see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:
  - ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:
  - ☐ any table(s) related to sequence listing *(specify)*:

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since either they are considered to go beyond the disclosure as filed, or they were not accompanied by a letter indicating the basis for the amendments in the application as filed, as indicated in the Supplemental Box (Rules 70.2(c) and (c-bis)):
  - ☐ the description, pages
  - ☐ the claims, Nos.
  - ☐ the drawings, sheets/figs
  - ☐ the sequence listing *(specify)*:

5. ☐ This opinion has been established taking into account the **rectification of an obvious mistake** authorized by or notified to this Authority under Rule 91 (Rule 70.2 (e)).

6. ☐ Supplementary international search report(s) from Authority(ies) have been received and taken into account in drawing up this report (Rule 45bis.8(b) and (c)).

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Yes:	Claims	1-12
	No:	Claims	
Inventive step (IS)	Yes:	Claims	1-12
	No:	Claims	
Industrial applicability (IA)	Yes:	Claims	1-12
	No:	Claims	

2. Citations and explanations (Rule 70.7):

see separate sheet

Re Item V

Reasoned statement with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1 Reference is made to the following documents:

D1 WO 2007/040410 A1 (DYNEA OY [FI]; PEDERSEN ASTRID [NO]; SANDBAKKEN PER OLAV [NO]) 12 April 2007 (2007-04-12)

D2 WO 03/033610 A1 (AKZO NOBEL NV [NL]; CASCO PRODUCTS AB [SE]; PIRHONEN SALME [SE]; NASLI) 24 April 2003 (2003-04-24)

D3 EP 1 136 537 A1 (AKZO NOBEL NV [NL]) 26 September 2001 (2001-09-26)

D4 EP 0 062 389 A1 (METHANOL CHEMIE NEDERLAND [NL]) 13 October 1982 (1982-10-13)

D5 EP 0 025 245 A2 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 18 March 1981 (1981-03-18)

D6 EP 0 107 260 A1 (METHANOL CHEMIE NEDERLAND [NL]; STAMICARBON [NL]) 2 May 1984 (1984-05-02)

2 The amendments filed with the letter dated 18-04-2013 do not introduce subject-matter which extends beyond the content of the application as filed, (Article 34(2)(b) PCT).

3 The application fulfils the requirements of Article 33(2) PCT.

3.1 D1 (claims 1,5,10) discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol, wherein the hardener part and/or the polymer dispersion part can contain a functionalized polyvinylacetate (PVAc). D1 (page 9, lines 13-15) discloses the amount of urea to be from about 1 to about 15 % by weight of the adhesive system.

The adhesive system of claim 1 of the application comprises less than 0.9 wt % of urea based on the weight of the entire adhesive system.

3.2 D2 (claim 1) discloses an adhesive system comprising a melaminic amino resin and a phenolic resin composition, which comprises an acid. D2 (page 3, lines 17-20) discloses that the"aldehyde to amino compound ratio", which is the molar ratio aldehyde to amino compound used when making the amino resin of the claimed adhesive system, is suitably less than 2.4, preferably from about 0.5 to about 2. 3, most preferably from about 0.7 to about 2. D2 (page 3, lines 29-30) discloses that homopolymers or copolymers of vinylesters, such as vinyl acetate, vinyl propionate, and vinyl butyrate, may also be used as components of the composition.

D2 does not disclose all the components in one single embodiment. D2 also does not discloses the F/NH2 ratio as defined in present claim 1 of the application, namely as molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups.

3.3 D3 (claims 1,10-12) discloses an adhesive system characterised in that it comprises, (a) an etherified amino resin, (b) a polymer prepared from one or more ethylenically unsaturated monomers, (c) a curing agent, and optionally (d) a polyvinyl alcohol. The polymer (b) is a copolymer of vinyl acetate and N-methylol-acrylamid and the curing agent (c) is a carboxylic acid.

D3 however does not disclose the F/NH2 ratio as defined in claim 1 of the application or any equivalent parameter.

3.4 D4-D6 all relate to UF resins with low F/NH2 ratio to be used for particle board hardened and pressed at elevated temperatures.

However, none of D4-D6 discloses that the adhesive system comprises an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or polyethylene vinylacetate (EVA).

4 The subject-matter of the claims involves the presence of an inventive step (Article 33(3) PCT).

4.1 Technical field and problem of the application.

- technical field: adhesive systems comprising amino resins for producing wood based products
- problem: providing an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

4.2 Document D1 can be selected to represent the <u>closest prior art</u> because D1 (claims 1,5,10) discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol, wherein the hardener part and/or the polymer dispersion part can contain a functionalized polyvinylacetate (PVAc). D1 (page 9, lines 13-15) discloses the amount of urea to be from about 1 to about 15 % by weight of the adhesive system.

4.3 The <u>difference</u> between the closest prior art and the application is that the adhesive system of claim 1 of the application comprises less than 0.9 wt% of urea based on the weight of the entire adhesive system.

4.4 The <u>effect of this difference</u> is shorter press times and low formaldehyde emissions as shown in the examples and comparative examples (description, pages 9-11).

4.5 The <u>objective technical problem</u> in view of the closest prior art can therefore be formulated as providing an adhesive system which results in shorter press times and low formaldehyde emissions.

4.6 This is not obvious for the following reasons:

Starting from D1 the skilled person with the aim of providing an adhesive system enabling both short press time and low emissions would not even consider omitting or lowering the amount of urea because D1 teaches explicitly to work within a range of about 1% to about 15% by weight of the adhesive system. None of the cited documents D2-D6 provides any indication to modify the amount of urea in order to achieve shorter press times and lower formaldehyde emissions. The skilled person starting from D1 would not find the required information to modify the teaching of D1 in order to arrive at the subject-matter of claim 1. Claim 1 thus involves the presence of an inventive step. Claims 2-12 are dependent on claim 1 and thus also involve the presence of an inventive step.

As a consequence the presence of an inventive step can be acknowledged.

Akzo Nobel N.V.
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European Patent Office
Patentlaan 2
2280 HV RIJSWIJK
The Netherlands

April 18, 2013

Your ref: PCT/EP2012/063766
Our ref : SWE11195 WOP1

Re: International Patent Application No. PCT/EP2012/063766
Applicant: Akzo Nobel Coatings International B.V.

Dear Sirs,

Reference is made to the Written Opinion by the International Search Authority pursuant to Rule 43bis.1 PCT dated August 9, 2012 in respect of the above-identified application. Hereby by a new set of amended claims is submitted along with the following observations:

Amendments

Claim 1 has been amended by specifying the polymer to comprise at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA), which is supported by original claim 8. As a consequence, claims 6-8 have been deleted, while claims 9-15 have been renumbered and their dependencies brought into conformance with the new numbering.

Claim 1 has been further amended by including the definition of the F/NH_2 ratio as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, which is supported by the original description page 3, lines 13-15.

Clarity

The objections to the clarity have been overcome by the claim amendments.

The Invention

The present invention relates to an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous dispersion of at least one polymer comprising at

least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA); wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

It has been found that the invention solves the problem of providing an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

Cited documents

D1 = WO 2007/040410

D2 = WO 03/033610

D3 = EP 1136537

D4 = EP 0062389

D5 = EP0025245

D6 = EP 0107260

Novelty

The International Search Authority has asserted that the claims lack novelty since all documents D1-D6 disclose urea based amino resins with the proper F/NH$_2$ ratio and a hardener compound. However, as will be shown below none of the documents do disclose all features of claim 1.

D1 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

The adhesive system of present claim 1 is distinguished from D1 by specifying that it comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

D2 discloses an adhesive system comprising a melaminic amino resin composition and a phenolic resin composition. The most preferred molar ratio aldehyde to amino compound is from about 0.7 to about 2. However, no preferred F/NH$_2$ is mentioned for resins predominantly based on urea.

The adhesive system of present claim 1 is distinguished from D2 by the combination of the claimed F/NH$_2$ ratio in a urea based amino resin (meaning that urea constitutes from 75 to 100 wt% of compounds carrying -NH$_2$ or -NH groups) and further in combination with a polymer dispersion comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA). Such a combination can only be arrived at by combining several lists and sub-ranges and does constitute a novel selection that is not unambiguously derivable from D2.

D3 discloses an adhesive system comprising an etherified amino resin. However, the F/NH$_2$ or any equivalent parameter is not disclosed and D3 cannot for this reason anticipate present claim 1.

D4-D6 all relate to UF resins with low F/NH$_2$ ratio to be used for particle board pressed at very high temperatures. However, none of D4-D6 discloses any

adhesive system comprising a dispersion of a polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA) as recited in present claim 1.

Accordingly, it is evident that none of the cited documents destroy the novelty of present claim 1.

Claims 2-12 include all limitations of claim 1 and are novel for the same reason.

Inventive step

The International Search Authority Examiner has not discussed the inventive step. Nevertheless, it is submitted that there is no ground for lack of inventive step.

Reasonably D1 is regarded as the closest prior art as has the highest amount of structural similarities as the present invention and also relate to the same problem.

As set out above, claim 1 of the present application is distinguished from D1 by specifying that the adhesive system comprises no or less than 0.9 wt% urea, in addition to the urea present in the amino resin.

As shown in the Examples of the present application the claimed combination of the specified F/NH_2 and absence of urea gave both short press time and low emissions. On the other hand, with significant amounts or urea in the system, the press time required for giving sufficient bond strength was significantly longer. Furthermore, with systems based on Hardener 4 representing D1 (WO 2007/040410) sufficient bond strength for passing the test was not even reached. Thus, it is apparent that the distinguishing features do solve the problem.

A person skilled in the art starting from D1 and aiming at solving the problem of providing an adhesive system enabling both short press time and low emissions would not even consider omitting or lower the amount of urea since this would go against the entire teaching of D1. Furthermore, none of D2-D6 provides any incentive to go against this teaching in order to solve the above problem. Therefore, claim 1 of the present application cannot have been obvious to a person skilled in the art and does for this reason involve an inventive step.

Claims 2-12 include all limitations of claim 1 and are inventive for the same reason.

Final remarks

In view of the above submissions it is requested that a positive International Preliminary Examination Report is issued for the new claims filed. Should there be any outstanding objections, it is requested that the International Preliminary Examination Authority issues a further Written Opinion or, if such objections are believed to be possible to easily resolve, contacts the undersigned agent for a telephone discussion.

Yours faithfully,

Christer Jönsson
(Association No. 485 – G.A. 598670.8)

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65, the F/NH_2 ratio being defined as the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous dispersion of at least one polymer comprising at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA);

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

7. Adhesive system as claimed in any one of the claims 1-6, wherein the hardener component comprise at least one aluminium salt.

8. Adhesive system as claimed in any one of the claims 1-7, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

9. Adhesive system as claimed in any one of the claims 1-8, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

10. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-9 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

11. Wood based product obtainable by the method according to claim 10.

12. Use of an adhesive system according to any one of the claims 1-9 for joining one or more pieces of a wooden material with one or more further pieces of a material.

Electronic Patent Application Fee Transmittal

Application Number:	
Filing Date:	
Title of Invention:	ADHESIVE SYSTEM
First Named Inventor/Applicant Name:	Jenny ADRIAN MEREDITH
Filer:	Kevin Todd Godlewski/Neil Benowitz
Attorney Docket Number:	13877/48501

Filed as Large Entity

U.S. National Stage under 35 USC 371 Filing Fees

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
Basic Filing:				
National Stage Fee	1631	1	280	280
Natl Stage Search Fee - Report provided	1642	1	480	480
National Stage Exam - all other cases	1633	1	720	720
Pages:				
Claims:				
Miscellaneous-Filing:				
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Patent-Appeals-and-Interference:				

Description	Fee Code	Quantity	Amount	Sub-Total in USD($)
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Document Number	Document Description	File Name	File Size(Bytes)/ Message Digest	Multi Part /.zip	Pages (if appl.)
1		13877-48501-USNP.pdf	7000653 4ec6561a8a973cf5b01c600206ed73498af73406	yes	72

Multipart Description/PDF files in .zip description

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2	Fee Worksheet (SB06)	fee-info.pdf	33223 b0eebf1472a507670f96174f5c7f6cc1b350eb4a	no	2
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Bescheinigung	Certificate	Attestation
Die angehefteten Unterlagen stimmen mit der als ursprünglich eingereicht geltenden Fassung der auf dem nächsten Blatt bezeichneten europäischen Patentanmeldung überein.	The attached documents are exact copies of the text in which the European patent application described on the following page is deemed to have been filed.	Les documents joints à la présente attestation sont conformes au texte, considéré comme initialement déposé, de la demande de brevet européen qui est spécifiée à la page suivante.
Patentanmeldung Nr.	**Patent application No.**	**Demande de brevet n°**

11174128.6 / EP11174128

The organization code and number of your priority application, to be used for filing abroad under the Paris Convention, is EP11174128.

Der Präsident des Europäischen Patentamts;
Im Auftrag

For the President of the European Patent Office

Le President de l'Office européen des brevets
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R.C. van Dijk

Anmeldung Nr: Application no.: Demande no :	11174128.6	Anmeldetag: Date of filing: Date de dépôt :	15.07.11

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Bezeichnung der Erfindung / Title of the invention / Titre de l'invention:
(Falls die Bezeichnung der Erfindung nicht angegeben ist, siehe Beschreibung.
If no title is shown please refer to the description.
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Adhesive system

In Anspruch genommene Priorität(en) / Priority(Priorities) claimed / Priorité(s) revendiquée(s)
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ADHESIVE SYSTEM

The invention relates to an adhesive system, methods in which the system is used and products obtainable thereby.

Adhesive systems comprising amino resins are widely used in the production of wood based products. Examples of amino resins include urea-formaldehyde (UF), melamine-formaldehyde (MF) and urea-melamine-formaldehyde (MUF). Examples of wood based products include composite products comprising layers glued together such as plywood, laminated flooring products and veneered products used in, e.g., furniture.

Upon curing an amino resin, formaldehyde may be released both during the manufacture of wood based products and also later during use of the products. Formaldehyde emission to indoor air is a major concern for health reasons.

US 4409293 discloses that formaldehyde emissions from UF resins can be decreased by using a resin having a formaldehyde to urea molar ratio from 1.0:1 to 1.2:1.

However, using a resin with too low formaldehyde to urea ratio requires high press temperature and/or long press times in order to achieve satisfactory bonding. High temperature increases the energy consumption while long press time reduces the production capacity. Further, too high press temperature is not suitable for many kinds of products.

WO 2007/040410 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

However, although addition of significant amounts of urea reduces the formaldehyde emissions, it also leads to longer press times being required.

It is an object of the invention to provide an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

One aspect of the present invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous polymer dispersion; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

A further aspect of the invention concerns a method of producing a wood based product, comprising applying an adhesive system of the invention onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

Still a further aspect of the invention concerns a wood based product obtainable by the method of the invention. Such a product comprises comprising wooden material and cured adhesive.

Still a further aspect of the invention concerns use of an adhesive system of the invention for joining one or more pieces of a wooden material with one or more further pieces of a material.

The term “adhesive system“ as used herein refers to a combination of components which function as and is intended to be used together as an adhesive. The components may be present in the same adhesive composition comprising all the components necessary for its function as an adhesive or in separate compositions, such as an adhesive composition and a hardener, functioning as an adhesive when combined. Such separate compositions may be mixed shortly before application to the surfaces to be joined or be applied separately to the surfaces. In the present invention, the resin component and the hardener component are usually kept separated and not mixed until during or shortly before use. The aqueous polymer dispersion may be included in the hardener component but may also be a separate component that is mixed with the other components during or shortly before use. The adhesive system of the invention is particularly useful for joining pieces of wooden materials.

The term “amino resin” as used herein refers to a condensation product of formaldehyde and at least one compound carrying –NH_2 or –NH groups. Such compounds include, for example, urea and melamine and resins include, for example, UF, MF and MUF resins.

The term “urea based amino resin” as used herein refers to amino resins, such as UF and MUF, in which urea constitutes from 50 to 100 wt%, for example from 75 to 100 wt% or from 90 to 100 wt% of said at least one compound carrying -NH_2 or -NH groups. However, also other compounds comprising reactive nitrogen may be included at the preparation of the resins, such as NH_3 or hexamine.

MUF resins may be based on a mixture of a UF resin and a MUF resin prepared separately, but may also be a co-condensation product of melamine, urea and formaldehyde. Urea based amino resins of the kinds mentioned above are commercially available at various ratios between the constituents, for example between melamine and urea and between the amine and formaldehyde.

The term “F/NH_2 ratio” is commonly used in the art of amino resins for characterising the amount of formaldehyde compared to the amount of reactive nitrogen in the raw materials used for preparing the resin. The term as used herein refers to the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, such as in the ring structure of melamine, if used. Thus, even if written as “NH_2” most of the nitrogen in the final resin is not in the form of NH_2 and does further include also nitrogen originating from optional other reactive nitrogen containing groups in the raw materials of the resin. Further, most of the formaldehyde is reacted in the final resin, but the amount used can be determined after hydrolysing the resin. If urea is the only nitrogen containing compound used for the resin, the F/NH_2 is equal to ½ of the F/U ratio. The urea based amino resin of the present invention has an F/NH_2 molar ratio from 0.3 to 0.65, for example from 0.4 to 0.6 or from 0.45 to 0.6. The F/NH_2 molar ratio may also be from 0.45 to 0.55 or from 0.45 to 0.5.

The term dry content as used herein refers to the content of anything in the adhesive system or a component thereof not being water. The entire adhesive system may, for example, comprise from 20 to 70 or from 40 to 60 wt% water.

The term wooden material as used herein refers not only to solid wood, but also to materials such as fibre-, chip-, and particleboard materials. The surfaces to be joined may be of the same or different types of materials. The pieces of wooden material can be any type and form such as chips, fibres, sheets, laminas, veneers, board products etc. The invention is particularly favourable for joining veneers onto a substrate, such as a board

material like any one of such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board.

The resin component comprises a urea based amino resin and may, for example, be an aqueous solution thereof. The resin component, including any water therein, may, for example, comprise from 50 to 90 wt% or from 65 to 80 wt% of urea based amino resin.

The hardener component comprises at least one acid, acid generating salt or acidic salt and may, for example, be an aqueous solution thereof. Examples of acids include organic acids like carboxylic acids as well as inorganic acids. Specific examples of acids include formic acid, acetic acid, maleic acid, citric acid, glycolic acid, lactic acid, malic acid, tartaric acid, phosphoric acid, hydrochloric acid, sulphamic acid, sulphonic acid and para-toluene sulphonic acid. Examples of acid generating salts include ammonium salts such as ammonium chloride, ammonium sulphate and ammonium phosphate, as well as organic salts like ethylene diamine salts. Examples of acidic salts include metal salts such as acidic aluminium, zirconium, zink, magnesium and calcium salts, for example those that are water soluble of chloride, nitrate and sulphate, like aluminium chloride, aluminium nitrate and aluminium sulphate. The concentration of acid, acid generating salt or acidic salt in the hardener component may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt%. The hardener component may further comprise additives used in the art such as fillers like kaolin, chalc, wood flour, coconut meal etc. Other possible additives include, for example, cellulose derivates like carboxymethyl cellulose (CMC) or hydroxyethyl cellulose (HEC). The dry content of the hardener component may, for example, be from 20 to 80 wt% or from 35 to 60 wt%.

The aqueous polymer dispersion comprise finely dispersed particle of at least one polymer, for example in an amount from 20 to80 wt% or from 30 to 70 wt% polymer in the aqueous dispersion. The polymer may, for example, be at least one synthetic polymer, such as homo- and co-polymers made from ethylenically unsaturated monomers like vinyl monomers. Examples of polymers include homo- or co-polymers of vinylacetate, homo or co-polymers of esters of (meth)acrylic acid, homo-or co-polymers of (meth)acrylamide, homo- or co-polymers of (meth)acrylic acid or homo- or co-polymers of vinyl alcohol. Further examples include and styrene-butadiene co-polymers. More specific examples of polymers include polyvinyl acetate (PVAc), polyethylene vinylacetate (EVA), co-polymers of vinylchloride and vinylacetate or ethylene vinylacetate, polyethylene-acrylic acid (PEAA), ethylene methyl acrylate copolymer (EMA), polyethyl methacrylate (PEMA), co-

polymers of vinylacetate and other esters, such as alkyl esters of (meth)acrylic acid, styrene acrylate co-polymers, and styrene-butadiene rubber (SBR). Further examples of polymers include polyurethane. Particularly useful polymers include at least one of PVAc and EVA, especially EVA. Many polymers useful for the invention are commercially available as aqueous dispersions or solutions. The polymers can also be prepared by general methods known to those skilled in the art.

The term “(meth)acryl” as used herein refers to both acryl and methacryl equally. For example, (meth)acrylate refers to any of acrylate or methacrylate while (meth)acrylic acid refers to any of acrylic acid or methacrylic acid.

In some embodiments the polymer comprises functional groups. Such groups include, for example, at least one of carboxylic acid, anhydrides thereof, N-alkylol, N-alkoxymethyl or glycidyl groups. Such groups may, for example be incorporated into the polymer by copolymerising at least one monomer comprising at least one such group with the other monomers. Examples of such monomers include acrylic acid, methacrylic acid, crotonic acid, isocrotonic acid, itaconic acid, itaconic anhydride, maleic acid, maleic anhydride, fumaric acid N-alkylol (meth)acrylamides such as N-methylol (meth)acrylamide and N-(alkoxymethyl) (meth)acrylates such as N-(butoxymethyl) (meth)acrylamide or N-(iso-butoxymethyl) (meth)acrylamide. However, the polymer may also be free from such monomers and particularly from monomers comprising groups that may release formaldehyde like N-methylol acrylamide.

The average particle diameter of the dispersed polymer may, for example, be from 0.05 to 10 µm or from 0.1 to 5 µm. The weight average molecular weight M_w of the polymer may, for example, be from 100 000 to 4 000 000 or from 350 000 to 2 000 000.

In some embodiments the aqueous polymer dispersion is a separate component, for example comprising from 20 to 80 wt% or from 35 to 65 wt% of dispersed polymer particles. Such a separate component may be mixed with the hardener component and/or the resin component during or shortly before use of the adhesive system.

In some embodiments the aqueous polymer dispersion is included in the hardener component. The hardener component may then comprise at least one acid, acid generating salt or acidic salt as described above, usually dissolved in the aqueous phase, and dispersed polymer particles as described above. Such a hardener component may, for example, comprise from 0.1 to 10 wt% or from 1 to 5 wt% of acid, acid generating salt or acidic salt and from 20 to 80 wt% or from 35 to 65 of dispersed polymer particles. Examples of useful hardener components include those described in WO2001/070898, EP 0501174 and WO 2002/068178.

In some embodiments part of the polymer dispersion is a separate component and part of the dispersion is included in the hardener component.

The urea based amino resin usually comprise some free urea i.e. non-reacted urea, for example from 1 to 50 wt% or from 10 to 40 wt%, particularly from 15 to 35 wt% urea based on dry resin. However, in addition to the urea in the resin, the adhesive system of the invention comprises no or less than 0.9 wt% urea, for example less than 0.7 wt% urea or less than 0.5 wt% urea, particularly less than 0.3 wt% urea or less than 0.1 wt% urea, based on the total weight of the entire adhesive system.

Various ratios between the components in the adhesive system may be used. The amount of acid, acid generating salt and acidic salt in the adhesive system may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt% of the amount of dry urea based amino resin. Further, the weight ratio of dry urea based amino resin to dry polymer in the adhesive system may, for example, be from 45:1 to 1:15, particularly from 15:1 to 1:7 or from 5:1 to 1:3.

An adhesive system of the invention may further comprise additives such as polyvinyl alcohol (PVA), surfactants, emulsifiers, protective colloids, preservatives, antifoaming agents, viscosity adjusting agents; fillers such as kaolin or calcium carbonate, protein, starch, coalescing agents such as at least one of butyl di(ethylene)glycol acetate, diethyleneglycol monobutyl ether, diethyleneglycol monomethyl ether, diethyleneglycol dibensoate, dipropyleneglycol dibensoate, propylenecarbonate and dimethyl esters of glutarate, adipate or succinate, and other additives known to be suitable for use in wood adhesive formulations, including combinations thereof. Such additives may be included in any of the components, such as in at least one of the resin component or the hardener component.

In a method of the invention the resin component and the hardener component of the adhesive system are applied to at least one surface of one or more pieces of a wooden material, either separately or after being mixed shortly before application, for example from 30 seconds to 8 hours or from 1 to 30 minutes before application. When the components are applied separately, they may be applied to the same or to two different surfaces to be joined. After application of the adhesive system, the pieces to be joined are pressed together. The pressing time depends on the wood based product intended to be produced and may, for example, be from 5 seconds to 15 minutes, particularly from10 seconds to 10 minutes or from 20 seconds to 3 minutes. Also the temperature of the press depends on the product to be produced and may, for example, be from 20 to 180°C, particularly from 40 to 130°C or from 50 to 100°C.

The pieces of wooden material may be joined to other pieces of the same or different kind of wooden material or to non-wooden material like plastics or paper, for example in foiling applications.

Some embodiments of a method of the invention comprise applying the adhesive system onto a sheet-like material, and joining it with a further sheet-like material. The term sheet-like material as used herein refers to materials having dimensions in either the length or width directions, or both, that are much greater than the dimension of the material in the thickness direction; exemplary of sheet-like materials include lamellae, boards, veneer, and the like. For example, it is possible to make products by form pressing or to make products in which two or more different kinds of wood are joined, which is common in, for example, parquet flooring.

Some embodiments of the invention comprise applying the adhesive system onto a wooden board material, such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board, and joining the wooden material with another kind of material such as foils of paper or plastic materials.

A wood based product of the invention may, for instance, be a laminated or veneered material, such as laminated flooring, veneered flooring such as parquet flooring, a veneered furniture material, plywood (including curved plywood), wall panels, roofing panels, laminated beams.

The invention is further illustrated by means of the following non-limiting examples. Unless otherwise stated, parts and percentages refer to parts by weight and percent by weight, respectively.

Example 1

Three UF resins with different F/NH_2 were tested with four different hardeners.

Resin A: Molar ratio F/NH_2 = 0.6; dry content 66 wt%

Resin B: Molar ratio F/NH_2 = 0.5 dry content 71 wt%

Resin C: Molar ratio F/NH_2 = 0.45 dry content 70 wt%

The compositions of Hardeners 1-3 are shown in Table 1 below:

Table 1. Composition of Hardeners 1-3.

Ingredient	Hardener 1	Hardener 2	Hardener 3
Aqueous 55% EVA dispersion Vinnapas™ EP441	84.5%		
Aqueous 52% PVAc dispersion Vinac™ DPN-36		84.4%	
Aqueous 60% PVAc dispersion Mowilith™ DHSS3			78.6%
Aqueous $AlCl_3$ (28%)	15.3%	15.4%	15.3%
Water			5.9%
Other (colour, defoamer)	0.2%	0.2%	0.2%
Total concentration $AlCl_3$	4.3%	4.3%	4.3%
Total dry content	50.7%	48.2%	51.5%

Hardener 4 is based on WO 2007/040410 and is a mixture of Hardener I in Table 2 therein and Modifier 2 in Table 3 therein. Thus, a first composition was prepared from 4.0% aluminium chloride-6-hydrate, 4.0% mono ammonium phosphate, 2.2% polypropylene glycol, 37.4% resorcinol, 0.2% defoamer and colour, 0.45% xanthan gum, 5.0% lactic acid and 46.7% water. Further, a second composition was prepared from 65.9% Vinac DPN-36, 21.6% urea and 12.5% water. Then 13.3 parts of the first composition was mixed with 18.5 parts of the second composition. Using 31.8 parts of Hardener 4 with 100 parts UF resin thus corresponds to Mixture 6 in Table 3 of WO 2007/040410.

A press time study was performed with various combinations of the three resins A, B and C and the Hardeners 1-3. As a comparison trials were also made with Hardener 1 + 6% urea (referred to as 1U).

In the study pieces of 0.6 mm beech veneer were glued onto a particle board and pressed in a carver press with 5 x 0.6 mm pieces beech veneer creating a 3 mm distance to the press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C) and the strength of the bonds were evaluated when the glued constructions had reached room temperature (referred to as cold). The veneer was pulled off from the particle board by hand and the amount of fibre tear from the board on the veneer was estimated. Normally at least 80% fibre tear cold is required for passing the test, but lower values can be acceptable if the bond is strong. The press time refers to the shortest press time that could be used and still achieving sufficient bond strength for passing the test. The press times in minutes and seconds for the different combinations are shown in Table 2 below:

Table 2. Press times

Resin	Hardener	Ratio	Press time	Amount urea in the system$^{1)}$
A	1	100:50	1'30"	
A	1	100:75	1'15"	
A	1	100:100	1'	
A	2	100:50	1'30"	
A	2	100:75	1'15"	
A	2	100:100	1'	
A	3	100:50	1'30"	
A	3	100:75	1'15"	
A	3	100:100	1'	
A	1U	100:50	2'30"	2%
A	1U	100:75	2'30"	2.6%
A	1U	100:100	2'30"	3%
B	1	100:50	4'	
B	1	100:75	2'30"	
B	1	100:100	2'30"	
B	2	100:50	4'	
B	2	100:75	2'30"	
B	2	100:100	2'30"	
B	3	100:50	3'30"	
B	3	100:75	2'30"	
B	3	100:100	2'30"	
B	1U	100:50	7'	2%
B	1U	100:75	4'	2.6%
B	1U	100:100	2'30"	3%
B	4	100:31.8	Did not pass	3%
C	1	100:50	6'	
C	1	100:75	4'30"	
C	1	100:100	3'	

Resin	Hardener	Ratio	Press time	Amount urea in the system[1)]
C	2	100:50	6'	
C	2	100:75	5'	
C	2	100:100	4'	
C	3	100:50	6'	
C	3	100:75	5'	
C	3	100:100	3'	
C	1U	100:50	10'	2%
C	1U	100:75	6'	2.6%
C	1U	100:100	6'	3%
C	4	100:31.8	Did not pass	3%
C	4	100:63.6	Did not pass'	5%

1) Refers to urea in addition to what may be present in the UF resin.

It appears that addition of urea increased the press time. Further, Hardener 4 could not be used at all for gluing with resins B and C having the lowest F/NH_2 ratio.

Example 2

In order to further investigate the differences between the hardeners additional pressings were performed with resin A. The ratio glue/hardener was 100:100 and press times were fixed to 20 and 30 seconds, respectively. The material used was 0.6 mm birch veneer on a HDF board in a carver press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C). The quality of the glue line was evaluated by estimation of bond strength when the glued construction had reached room temperature. The veneer was pulled off from the HDF by hand and the amount of fibre tear from the board on the veneer was estimated.

Table 3. Fibre tear

Resin	Hardener	Ratio	Press time	Fibre tear	Amount Urea in the system[1)]
A	1	100:100	20"	80%	
A	1	100:100	30"	80%	
A	2	100:100	20"	70%	
A	2	100:100	30"	60%	
A	3	100:100	20"	60%	
A	3	100:100	30"	50%	
A	1U	100:100	20"	30%	3%
A	1U	100:100	30"	50%	3%

1) Refers to urea in addition to what may be present in the UF resin.

It appears that Hardener comprising EVA gave the best result, except when urea was added.

Example 3

The formaldehyde emission for some combinations were evaluated according to the standard JAS MAFF 233 (Pressing temperature: 90°C; Pressure: 0.8 MPa; Material: 10 beech veneers 1.5 mm; Glue spread 160 g/cm3; Pressing times 8, 10 or 12 minutes). The results are shown in Table 4 below:

Table 4. Formaldehyde emissions

Resin	**Hardener**	**Ratio**	**Emission (mg/l)**
A	1	100:40	0.7
B	1	100:40	0.2
C	1	100:40	0.1
A	2	100:40	0.9
B	2	100:40	0.2
C	2	100:40	0.1
A	3	100:40	1.1
B	3	100:40	0.2
C	3	100:40	0.1
A	4	100:31.8	0.2

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous polymer dispersion;

   wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises at least one homo- or co-polymer made from ethylenically unsaturated monomers.

7. Adhesive system as claimed in claim 6, wherein the at least one polymer comprises at least one homo- or co-polymers of vinylacetate.

8. Adhesive system as claimed in claim 7, wherein the at least one polymer comprises at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA).

9. Adhesive system as claimed in claim 8, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

10. Adhesive system as claimed in any one of the claims 1-9, wherein the hardener component comprise at least one aluminium salt.

11. Adhesive system as claimed in any one of the claims 1-10, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

12. Adhesive system as claimed in any one of the claims 1-11, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

13. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-12 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

14. Wood based product obtainable by the method according to claim 13.

15. Use of an adhesive system according to any one of the claims 1-12 for joining one or more pieces of a wooden material with one or more further pieces of a material.

ABSTRACT

The invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous polymer dispersion; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin. The invention further concerns a method of producing a wood based product, wood based products obtainable thereby and use of the adhesive system.

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APPLICATION NUMBER: ***61/508,205***
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Title of Invention:	Adhesive System
First Named Inventor/Applicant Name:	Jenny Adrian Meredith
Customer Number:	27624
Filer:	Robert C. Morriss
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1	Provisional Cover Sheet (SB16)	SWE11195-07-15-11Provisional-Cover-Sheet-SB-16.pdf	1060254 db4bb88a841f6902338fdf4a00bf64d83bdb292d	no	4

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Document Description	Start	End
Specification	1	11
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Abstract	14	14

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Doc Code: **TR.PROV**
Document Description: Provisional Cover Sheet (SB16)

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Provisional Application for Patent Cover Sheet

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Inventor(s)

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Title of Invention	Adhesive System
Attorney Docket Number (if applicable)	SWE 11195 PRUS

Correspondence Address

Direct all correspondence to (select one):

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Customer Number	27624

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First Name	Robert C.	Last Name	Morriss	Registration Number (If appropriate)	42910

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ADHESIVE SYSTEM

The invention relates to an adhesive system, methods in which the system is used and products obtainable thereby.

Adhesive systems comprising amino resins are widely used in the production of wood based products. Examples of amino resins include urea-formaldehyde (UF), melamine-formaldehyde (MF) and urea-melamine-formaldehyde (MUF). Examples of wood based products include composite products comprising layers glued together such as plywood, laminated flooring products and veneered products used in, e.g., furniture.

Upon curing an amino resin, formaldehyde may be released both during the manufacture of wood based products and also later during use of the products. Formaldehyde emission to indoor air is a major concern for health reasons.

US 4409293 discloses that formaldehyde emissions from UF resins can be decreased by using a resin having a formaldehyde to urea molar ratio from 1.0:1 to 1.2:1.

However, using a resin with too low formaldehyde to urea ratio requires high press temperature and/or long press times in order to achieve satisfactory bonding. High temperature increases the energy consumption while long press time reduces the production capacity. Further, too high press temperature is not suitable for many kinds of products.

WO 2007/040410 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

However, although addition of significant amounts of urea reduces the formaldehyde emissions, it also leads to longer press times being required.

It is an object of the invention to provide an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

One aspect of the present invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous polymer dispersion; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

A further aspect of the invention concerns a method of producing a wood based product, comprising applying an adhesive system of the invention onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

Still a further aspect of the invention concerns a wood based product obtainable by the method of the invention. Such a product comprises comprising wooden material and cured adhesive.

Still a further aspect of the invention concerns use of an adhesive system of the invention for joining one or more pieces of a wooden material with one or more further pieces of a material.

The term "adhesive system" as used herein refers to a combination of components which function as and is intended to be used together as an adhesive. The components may be present in the same adhesive composition comprising all the components necessary for its function as an adhesive or in separate compositions, such as an adhesive composition and a hardener, functioning as an adhesive when combined. Such separate compositions may be mixed shortly before application to the surfaces to be joined or be applied separately to the surfaces. In the present invention, the resin component and the hardener component are usually kept separated and not mixed until during or shortly before use. The aqueous polymer dispersion may be included in the hardener component but may also be a separate component that is mixed with the other components during or shortly before use. The adhesive system of the invention is particularly useful for joining pieces of wooden materials.

The term "amino resin" as used herein refers to a condensation product of formaldehyde and at least one compound carrying $-NH_2$ or $-NH$ groups. Such compounds include, for example, urea and melamine and resins include, for example, UF, MF and MUF resins.

The term “urea based amino resin” as used herein refers to amino resins, such as UF and MUF, in which urea constitutes from 50 to 100 wt%, for example from 75 to 100 wt% or from 90 to 100 wt% of said at least one compound carrying -NH_2 or -NH groups. However, also other compounds comprising reactive nitrogen may be included at the preparation of the resins, such as NH_3 or hexamine.

MUF resins may be based on a mixture of a UF resin and a MUF resin prepared separately, but may also be a co-condensation product of melamine, urea and formaldehyde. Urea based amino resins of the kinds mentioned above are commercially available at various ratios between the constituents, for example between melamine and urea and between the amine and formaldehyde.

The term “F/NH_2 ratio” is commonly used in the art of amino resins for characterising the amount of formaldehyde compared to the amount of reactive nitrogen in the raw materials used for preparing the resin. The term as used herein refers to the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, such as in the ring structure of melamine, if used. Thus, even if written as “NH_2” most of the nitrogen in the final resin is not in the form of NH_2 and does further include also nitrogen originating from optional other reactive nitrogen containing groups in the raw materials of the resin. Further, most of the formaldehyde is reacted in the final resin, but the amount used can be determined after hydrolysing the resin. If urea is the only nitrogen containing compound used for the resin, the F/NH_2 is equal to ½ of the F/U ratio. The urea based amino resin of the present invention has an F/NH_2 molar ratio from 0.3 to 0.65, for example from 0.4 to 0.6 or from 0.45 to 0.6. The F/NH_2 molar ratio may also be from 0.45 to 0.55 or from 0.45 to 0.5.

The term dry content as used herein refers to the content of anything in the adhesive system or a component thereof not being water. The entire adhesive system may, for example, comprise from 20 to 70 or from 40 to 60 wt% water.

The term wooden material as used herein refers not only to solid wood, but also to materials such as fibre-, chip-, and particleboard materials. The surfaces to be joined may be of the same or different types of materials. The pieces of wooden material can be any type and form such as chips, fibres, sheets, laminas, veneers, board products etc. The invention is particularly favourable for joining veneers onto a substrate, such as a board

material like any one of such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board.

The resin component comprises a urea based amino resin and may, for example, be an aqueous solution thereof. The resin component, including any water therein, may, for example, comprise from 50 to 90 wt% or from 65 to 80 wt% of urea based amino resin.

The hardener component comprises at least one acid, acid generating salt or acidic salt and may, for example, be an aqueous solution thereof. Examples of acids include organic acids like carboxylic acids as well as inorganic acids. Specific examples of acids include formic acid, acetic acid, maleic acid, citric acid, glycolic acid, lactic acid, malic acid, tartaric acid, phosphoric acid, hydrochloric acid, sulphamic acid, sulphonic acid and para-toluene sulphonic acid. Examples of acid generating salts include ammonium salts such as ammonium chloride, ammonium sulphate and ammonium phosphate, as well as organic salts like ethylene diamine salts. Examples of acidic salts include metal salts such as acidic aluminium, zirconium, zink, magnesium and calcium salts, for example those that are water soluble of chloride, nitrate and sulphate, like aluminium chloride, aluminium nitrate and aluminium sulphate. The concentration of acid, acid generating salt or acidic salt in the hardener component may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt%. The hardener component may further comprise additives used in the art such as fillers like kaolin, chalc, wood flour, coconut meal etc. Other possible additives include, for example, cellulose derivates like carboxymethyl cellulose (CMC) or hydroxyethyl cellulose (HEC). The dry content of the hardener component may, for example, be from 20 to 80 wt% or from 35 to 60 wt%.

The aqueous polymer dispersion comprise finely dispersed particle of at least one polymer, for example in an amount from 20 to80 wt% or from 30 to 70 wt% polymer in the aqueous dispersion. The polymer may, for example, be at least one synthetic polymer, such as homo- and co-polymers made from ethylenically unsaturated monomers like vinyl monomers. Examples of polymers include homo- or co-polymers of vinylacetate, homo or co-polymers of esters of (meth)acrylic acid, homo-or co-polymers of (meth)acrylamide, homo- or co-polymers of (meth)acrylic acid or homo- or co-polymers of vinyl alcohol. Further examples include and styrene-butadiene co-polymers. More specific examples of polymers include polyvinyl acetate (PVAc), polyethylene vinylacetate (EVA), co-polymers of vinylchloride and vinylacetate or ethylene vinylacetate, polyethylene-acrylic acid (PEAA), ethylene methyl acrylate copolymer (EMA), polyethyl methacrylate (PEMA), co-

polymers of vinylacetate and other esters, such as alkyl esters of (meth)acrylic acid, styrene acrylate co-polymers, and styrene-butadiene rubber (SBR). Further examples of polymers include polyurethane. Particularly useful polymers include at least one of PVAc and EVA, especially EVA. Many polymers useful for the invention are commercially available as aqueous dispersions or solutions. The polymers can also be prepared by general methods known to those skilled in the art.

The term "(meth)acryl" as used herein refers to both acryl and methacryl equally. For example, (meth)acrylate refers to any of acrylate or methacrylate while (meth)acrylic acid refers to any of acrylic acid or methacrylic acid.

In some embodiments the polymer comprises functional groups. Such groups include, for example, at least one of carboxylic acid, anhydrides thereof, N-alkylol, N-alkoxymethyl or glycidyl groups. Such groups may, for example be incorporated into the polymer by copolymerising at least one monomer comprising at least one such group with the other monomers. Examples of such monomers include acrylic acid, methacrylic acid, crotonic acid, isocrotonic acid, itaconic acid, itaconic anhydride, maleic acid, maleic anhydride, fumaric acid N-alkylol (meth)acrylamides such as N-methylol (meth)acrylamide and N-(alkoxymethyl) (meth)acrylates such as N-(butoxymethyl) (meth)acrylamide or N-(iso-butoxymethyl) (meth)acrylamide. However, the polymer may also be free from such monomers and particularly from monomers comprising groups that may release formaldehyde like N-methylol acrylamide.

The average particle diameter of the dispersed polymer may, for example, be from 0.05 to 10 μm or from 0.1 to 5 μm. The weight average molecular weight M_w of the polymer may, for example, be from 100 000 to 4 000 000 or from 350 000 to 2 000 000.

In some embodiments the aqueous polymer dispersion is a separate component, for example comprising from 20 to 80 wt% or from 35 to 65 wt% of dispersed polymer particles. Such a separate component may be mixed with the hardener component and/or the resin component during or shortly before use of the adhesive system.

In some embodiments the aqueous polymer dispersion is included in the hardener component. The hardener component may then comprise at least one acid, acid generating salt or acidic salt as described above, usually dissolved in the aqueous phase, and dispersed polymer particles as described above. Such a hardener component may, for example, comprise from 0.1 to 10 wt% or from 1 to 5 wt% of acid, acid generating salt or acidic salt and from 20 to 80 wt% or from 35 to 65 of dispersed polymer particles. Examples of useful hardener components include those described in WO2001/070898, EP 0501174 and WO 2002/068178.

In some embodiments part of the polymer dispersion is a separate component and part of the dispersion is included in the hardener component.

The urea based amino resin usually comprise some free urea i.e. non-reacted urea, for example from 1 to 50 wt% or from 10 to 40 wt%, particularly from 15 to 35 wt% urea based on dry resin. However, in addition to the urea in the resin, the adhesive system of the invention comprises no or less than 0.9 wt% urea, for example less than 0.7 wt% urea or less than 0.5 wt% urea, particularly less than 0.3 wt% urea or less than 0.1 wt% urea, based on the total weight of the entire adhesive system.

Various ratios between the components in the adhesive system may be used. The amount of acid, acid generating salt and acidic salt in the adhesive system may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt% of the amount of dry urea based amino resin. Further, the weight ratio of dry urea based amino resin to dry polymer in the adhesive system may, for example, be from 45:1 to 1:15, particularly from 15:1 to 1:7 or from 5:1 to 1:3.

An adhesive system of the invention may further comprise additives such as polyvinyl alcohol (PVA), surfactants, emulsifiers, protective colloids, preservatives, antifoaming agents, viscosity adjusting agents; fillers such as kaolin or calcium carbonate, protein, starch, coalescing agents such as at least one of butyl di(ethylene)glycol acetate, diethyleneglycol monobutyl ether, diethyleneglycol monomethyl ether, diethyleneglycol dibensoate, dipropyleneglycol dibensoate, propylenecarbonate and dimethyl esters of glutarate, adipate or succinate, and other additives known to be suitable for use in wood adhesive formulations, including combinations thereof. Such additives may be included in any of the components, such as in at least one of the resin component or the hardener component.

In a method of the invention the resin component and the hardener component of the adhesive system are applied to at least one surface of one or more pieces of a wooden material, either separately or after being mixed shortly before application, for example from 30 seconds to 8 hours or from 1 to 30 minutes before application. When the components are applied separately, they may be applied to the same or to two different surfaces to be joined. After application of the adhesive system, the pieces to be joined are pressed together. The pressing time depends on the wood based product intended to be produced and may, for example, be from 5 seconds to 15 minutes, particularly from10 seconds to 10 minutes or from 20 seconds to 3 minutes. Also the temperature of the press depends on the product to be produced and may, for example, be from 20 to 180°C, particularly from 40 to 130°C or from 50 to 100°C.

The pieces of wooden material may be joined to other pieces of the same or different kind of wooden material or to non-wooden material like plastics or paper, for example in foiling applications.

Some embodiments of a method of the invention comprise applying the adhesive system onto a sheet-like material, and joining it with a further sheet-like material. The term sheet-like material as used herein refers to materials having dimensions in either the length or width directions, or both, that are much greater than the dimension of the material in the thickness direction; exemplary of sheet-like materials include lamellae, boards, veneer, and the like. For example, it is possible to make products by form pressing or to make products in which two or more different kinds of wood are joined, which is common in, for example, parquet flooring.

Some embodiments of the invention comprise applying the adhesive system onto a wooden board material, such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board, and joining the wooden material with another kind of material such as foils of paper or plastic materials.

A wood based product of the invention may, for instance, be a laminated or veneered material, such as laminated flooring, veneered flooring such as parquet flooring, a veneered furniture material, plywood (including curved plywood), wall panels, roofing panels, laminated beams.

The invention is further illustrated by means of the following non-limiting examples. Unless otherwise stated, parts and percentages refer to parts by weight and percent by weight, respectively.

Example 1

Three UF resins with different F/NH_2 were tested with four different hardeners.
Resin A: Molar ratio $F/NH_2 = 0.6$; dry content 66 wt%
Resin B: Molar ratio $F/NH_2 = 0.5$ dry content 71 wt%
Resin C: Molar ratio $F/NH_2 = 0.45$ dry content 70 wt%

The compositions of Hardeners 1-3 are shown in Table 1 below:

Table 1. Composition of Hardeners 1-3.

Ingredient	**Hardener 1**	**Hardener 2**	**Hardener 3**
Aqueous 55% EVA dispersion Vinnapas™ EP441	84.5%		
Aqueous 52% PVAc dispersion Vinac™ DPN-36		84.4%	
Aqueous 60% PVAc dispersion Mowilith™ DHSS3			78.6%
Aqueous $AlCl_3$ (28%)	15.3%	15.4%	15.3%
Water			5.9%
Other (colour, defoamer)	0.2%	0.2%	0.2%
Total concentration $AlCl_3$	4.3%	4.3%	4.3%
Total dry content	50.7%	48.2%	51.5%

Hardener 4 is based on WO 2007/040410 and is a mixture of Hardener I in Table 2 therein and Modifier 2 in Table 3 therein. Thus, a first composition was prepared from 4.0% aluminium chloride-6-hydrate, 4.0% mono ammonium phosphate, 2.2% polypropylene glycol, 37.4% resorcinol, 0.2% defoamer and colour, 0.45% xanthan gum, 5.0% lactic acid and 46.7% water. Further, a second composition was prepared from 65.9% Vinac DPN-36, 21.6% urea and 12.5% water. Then 13.3 parts of the first composition was mixed with 18.5 parts of the second composition. Using 31.8 parts of Hardener 4 with 100 parts UF resin thus corresponds to Mixture 6 in Table 3 of WO 2007/040410.

A press time study was performed with various combinations of the three resins A, B and C and the Hardeners 1-3. As a comparison trials were also made with Hardener 1 + 6% urea (referred to as 1U).

In the study pieces of 0.6 mm beech veneer were glued onto a particle board and pressed in a carver press with 5 x 0.6 mm pieces beech veneer creating a 3 mm distance to the press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C) and the strength of the bonds were evaluated when the glued constructions had reached room temperature (referred to as cold). The veneer was pulled off from the particle board by hand and the amount of fibre tear from the board on the veneer was estimated. Normally at least 80% fibre tear cold is required for passing the test, but lower values can be acceptable if the bond is strong. The press time refers to the shortest press time that could be used and still achieving sufficient bond strength for passing the test. The press times in minutes and seconds for the different combinations are shown in Table 2 below:

Table 2. Press times

Resin	Hardener	Ratio	Press time	Amount urea in the system$^{1)}$
A	1	100:50	1'30"	
A	1	100:75	1'15"	
A	1	100:100	1'	
A	2	100:50	1'30"	
A	2	100:75	1'15"	
A	2	100:100	1'	
A	3	100:50	1'30"	
A	3	100:75	1'15"	
A	3	100:100	1'	
A	1U	100:50	2'30"	2%
A	1U	100:75	2'30"	2.6%
A	1U	100:100	2'30"	3%
B	1	100:50	4'	
B	1	100:75	2'30"	
B	1	100:100	2'30"	
B	2	100:50	4'	
B	2	100:75	2'30"	
B	2	100:100	2'30"	
B	3	100:50	3'30"	
B	3	100:75	2'30"	
B	3	100:100	2'30"	
B	1U	100:50	7'	2%
B	1U	100:75	4'	2.6%
B	1U	100:100	2'30"	3%
B	4	100:31.8	Did not pass	3%
C	1	100:50	6'	
C	1	100:75	4'30"	
C	1	100:100	3'	

Resin	Hardener	Ratio	Press time	Amount urea in the system[1]
C	2	100:50	6'	
C	2	100:75	5'	
C	2	100:100	4'	
C	3	100:50	6'	
C	3	100:75	5'	
C	3	100:100	3'	
C	1U	100:50	10'	2%
C	1U	100:75	6'	2.6%
C	1U	100:100	6'	3%
C	4	100:31.8	Did not pass	3%
C	4	100:63.6	Did not pass'	5%

[1] Refers to urea in addition to what may be present in the UF resin.

It appears that addition of urea increased the press time. Further, Hardener 4 could not be used at all for gluing with resins B and C having the lowest F/NH_2 ratio.

Example 2

In order to further investigate the differences between the hardeners additional pressings were performed with resin A. The ratio glue/hardener was 100:100 and press times were fixed to 20 and 30 seconds, respectively. The material used was 0.6 mm birch veneer on a HDF board in a carver press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C). The quality of the glue line was evaluated by estimation of bond strength when the glued construction had reached room temperature. The veneer was pulled off from the HDF by hand and the amount of fibre tear from the board on the veneer was estimated.

Table 3. Fibre tear

Resin	Hardener	Ratio	Press time	Fibre tear	Amount Urea in the system[1]
A	1	100:100	20"	80%	
A	1	100:100	30"	80%	
A	2	100:100	20"	70%	
A	2	100:100	30"	60%	
A	3	100:100	20"	60%	
A	3	100:100	30"	50%	
A	1U	100:100	20"	30%	3%
A	1U	100:100	30"	50%	3%

[1] Refers to urea in addition to what may be present in the UF resin.

It appears that Hardener comprising EVA gave the best result, except when urea was added.

Example 3

The formaldehyde emission for some combinations were evaluated according to the standard JAS MAFF 233 (Pressing temperature: 90°C; Pressure: 0.8 MPa; Material: 10 beech veneers 1.5 mm; Glue spread 160 g/cm3; Pressing times 8, 10 or 12 minutes). The results are shown in Table 4 below:

Table 4. Formaldehyde emissions

Resin	**Hardener**	**Ratio**	**Emission (mg/l)**
A	1	100:40	0.7
B	1	100:40	0.2
C	1	100:40	0.1
A	2	100:40	0.9
B	2	100:40	0.2
C	2	100:40	0.1
A	3	100:40	1.1
B	3	100:40	0.2
C	3	100:40	0.1
A	4	100:31.8	0.2

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous polymer dispersion;

   wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises at least one homo- or co-polymer made from ethylenically unsaturated monomers.

7. Adhesive system as claimed in claim 6, wherein the at least one polymer comprises at least one homo- or co-polymers of vinylacetate.

8. Adhesive system as claimed in claim 7, wherein the at least one polymer comprises at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA).

9. Adhesive system as claimed in claim 8, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

10. Adhesive system as claimed in any one of the claims 1-9, wherein the hardener component comprise at least one aluminium salt.

11. Adhesive system as claimed in any one of the claims 1-10, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

12. Adhesive system as claimed in any one of the claims 1-11, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

13. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-12 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

14. Wood based product obtainable by the method according to claim 13.

15. Use of an adhesive system according to any one of the claims 1-12 for joining one or more pieces of a wooden material with one or more further pieces of a material.

ABSTRACT

The invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous polymer dispersion; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin. The invention further concerns a method of producing a wood based product, wood based products obtainable thereby and use of the adhesive system.

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DOCUMENT MADE AVAILABLE UNDER THE PATENT COOPERATION TREATY (PCT)

International application number:		**PCT/EP2012/063766**
International filing date:		**13 July 2012 (13.07.2012)**
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Document details:	Country/Office:	**US**
	Number:	**61/508,205**
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Date of receipt at the International Bureau:		**30 July 2012 (30.07.2012)**

Remark: Priority document submitted or transmitted to the International Bureau in compliance with Rule 17.1(a),(b) or (b-*bis*)

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0	**For receiving Office use only**	
0-1	International Application No.	**PCT/EP2012/063766**
0-2	International Filing Date	**13 JUL 2012 (13.07.2012)**
0-3	Name of receiving Office and "PCT International Application"	**RO/EP**

0-4	**Form PCT/RO/101 PCT Request**	
0-4-1	Prepared Using	PCT Online Filing Version 3.5.000.225 MT/FOP 20020701/0.20.5.20
0-5	**Petition** The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	**Receiving Office (specified by the applicant)**	European Patent Office (EPO) (RO/EP)
0-7	**Applicant's or agent's file reference**	SWE11195WOP1
I	**Title of Invention**	ADHESIVE SYSTEM
II	**Applicant**	
II-1	This person is	Applicant only
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II-10(a)	E-mail authorization The receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority are authorized to use this e-mail address, if the Office or Authority so wishes, to send notifications issued in respect of this international application:	exclusively in electronic form (no paper notifications will be sent)
II-11	Applicant's registration No. with the Office	4492620.2

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III-1	**Applicant and/or inventor**	
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III-5-7	State of residence	SE
IV-1	**Agent or common representative; or address for correspondence** The person identified below is hereby/ has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	Agent
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IV-1-5(a)	E-mail authorization The receiving Office, the International Searching Authority, the International Bureau and the International Preliminary Examining Authority are authorized to use this e-mail address, if the Office or Authority so wishes, to send notifications issued in respect of this international application:	exclusively in electronic form (no paper notifications will be sent)
IV-1-6	Agent's registration No.	1.8
V	**DESIGNATIONS**	
V-1	**The filing of this request constitutes under Rule 4.9(a), the designation of all Contracting States bound by the PCT on the international filing date, for the grant of every kind of protection available and, where applicable, for the grant of both regional and national patents.**	
VI-1	**Priority claim of earlier regional application**	
VI-1-1	Filing date	15 July 2011 (15.07.2011)
VI-1-2	Number	11174128.6
VI-1-3	Regional Office	EP

VI-2	**Priority claim of earlier national application**	
VI-2-1	Filing date	**15 July 2011 (15.07.2011)**
VI-2-2	Number	**61/508,205**
VI-2-3	Country	**US**
VI-3	**Priority document request** The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	**VI-1**
VI-4	**Incorporation by reference :** where an element of the international application referred to in Article 11(1)(iii)(d) or (e) or a part of the description, claims or drawings referred to in Rule 20.5(a) is not otherwise contained in this international application but is completely contained in an earlier application whose priority is claimed on the date on which one or more elements referred to in Article 11(1)(iii) were first received by the receiving Office, that element or part is, subject to confirmation under Rule 20.6, incorporated by reference in this international application for the purposes of Rule 20.6.	
VII-1	**International Searching Authority Chosen**	**European Patent Office (EPO) (ISA/EP)**
VII-2	**Request to use results of earlier search; reference to that search**	
VII-2-1	Filing date	**15 July 2011 (15.07.2011)**
VII-2-2	Application Number	**11174128.6**
VII-2-3	Country (or regional Office)	**EP**
VII-2-4	Statement (Rule 4.12(ii)):	**This international application is the same, or substantially the same, as the application in respect of which the earlier search was carried out, except, where applicable, that it is filed in a different language.**
VII-2-5	Documents are available to the ISA in a form and manner acceptable to it and therefore do not need to be submitted by the applicant to the ISA (Rule 12bis.1(f)):	**A copy of the results of the earlier search** **A copy of the earlier application** **A copy of any document cited in the results of the earlier search**

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VIII	**Declarations**	Number of declarations	
VIII-1	Declaration as to the identity of the inventor	–	
VIII-2	Declaration as to the applicant's entitlement, as at the international filing date, to apply for and be granted a patent	–	
VIII-3	Declaration as to the applicant's entitlement, as at the international filing date, to claim the priority of the earlier application	–	
VIII-4	Declaration of inventorship (only for the purposes of the designation of the United States of America)	–	
VIII-5	Declaration as to non-prejudicial disclosures or exceptions to lack of novelty	–	
IX	**Check list**	Number of sheets	Electronic file(s) attached
IX-1	Request (including declaration sheets)	6	✓
IX-2	Description	11	✓
IX-3	Claims	2	✓
IX-4	Abstract	1	✓
IX-5	Drawings	0	–
IX-7	TOTAL	20	
	Accompanying Items	Paper document(s) attached	Electronic file(s) attached
IX-8	Fee calculation sheet	–	✓
IX-18	PCT-SAFE physical media	–	–
IX-20	**Figure of the drawings which should accompany the abstract**		
IX-21	**Language of filing of the international application**	English	
X-1	**Signature of applicant, agent or common representative**	/A.J. de Vries/	
X-1-1	Name (LAST, First)	DE VRIES, Adriaan Jacobus c.s.	
X-1-2	Name of signatory	DE VRIES, Adriaan Jacobus c.s.	
X-1-3	Capacity (if such capacity is not obvious from reading the request)	(Representative)	

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10-1	**Date of actual receipt of the purported international application**	**13 JUL 2012 (13.07.2012)**
10-2	**Drawings:**	
10-2-1	Received	
10-2-2	Not received	
10-3	**Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application**	
10-4	**Date of timely receipt of the required corrections under PCT Article 11(2)**	
10-5	**International Searching Authority**	**ISA/EP**
10-6	**Transmittal of search copy delayed until search fee is paid**	

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From the INTERNATIONAL BUREAU

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NOTIFICATION OF THE RECORDING OF A CHANGE

(PCT Rule 92*bis*.1 and
Administrative Instructions, Section 422)

To:

AKZO NOBEL IP DEPARTMENT
Velperweg 76
NL-6824 BM Arnheim
PAYS-BAS

Date of mailing *(day/month/year)* 03 May 2013 (03.05.2013)	
Applicant's or agent's file reference SWE11195WOP1	**IMPORTANT NOTIFICATION**
International application No. PCT/EP2012/063766	International filing date *(day/month/year)* 13 July 2012 (13.07.2012)

1. The following indications appeared on record concerning:

☐ the applicant ☐ the inventor ☒ the agent ☐ the common representative

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2. The International Bureau hereby notifies the applicant that the following change has been recorded concerning:

☒ the person ☐ the name ☐ the address ☐ the nationality ☐ the residence

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3. Further observations, if necessary:
A new agent has been appointed, as indicated in Box 2.

4. A copy of this notification has been sent to:

☒ the receiving Office
☐ the International Searching Authority
☐ the Authority(ies) specified for supplementary search
☐ the International Preliminary Examining Authority
☒ the designated Offices concerned
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☐ other:

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. +41 22 338 82 70	Authorized officer Nissen Diana e-mail diana.nissen@wipo.int Telephone No. +4122 338 8054

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(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

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(54) Title: ADHESIVE SYSTEM

(57) Abstract: The invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH$_2$ ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous polymer dispersion; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin. The invention further concerns a method of producing a wood based product, wood based products obtainable thereby and use of the adhesive system.

WO 2013/010932 A1

ADHESIVE SYSTEM

The invention relates to an adhesive system, use thereof, a method of producing a wood based product and products obtainable thereby.

Adhesive systems comprising amino resins are widely used in the production of wood based products. Examples of amino resins include urea-formaldehyde (UF), melamine-formaldehyde (MF) and urea-melamine-formaldehyde (MUF). Examples of wood based products include composite products comprising layers glued together such as plywood, laminated flooring products and veneered products used in, e.g., furniture.

Upon curing an amino resin, formaldehyde may be released both during the manufacture of wood based products and also later during use of the products. Formaldehyde emission to indoor air is a major concern for health reasons.

US 4409293 discloses that formaldehyde emissions from UF resins can be decreased by using a resin having a formaldehyde to urea molar ratio from 1.0:1 to 1.2:1.

However, using a resin with too low formaldehyde to urea ratio requires high press temperature and/or long press times in order to achieve satisfactory bonding. High temperature increases the energy consumption while long press time reduces the production capacity. Further, too high press temperature is not suitable for many kinds of products.

WO 2007/040410 discloses an adhesive system comprising a UF resin adhesive part; a hardener part comprising one or more curing agents; a polymer dispersion; and a formaldehyde scavenger comprising a combination of urea and resorcinol.

However, although addition of significant amounts of urea reduces the formaldehyde emissions, it also leads to longer press times being required.

It is an object of the invention to provide an adhesive system comprising a urea based amino resin with low or no emissions of formaldehyde but still being efficient as a wood adhesive without requiring extremely long press time or high temperature.

One aspect of the present invention concerns an adhesive system comprising (a) a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65; (b) a hardener component comprising at least one acid, acid generating salt or acidic salt; and, (c) an aqueous dispersion of at least one polymer; wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

A further aspect of the invention concerns a method of producing a wood based product, comprising applying an adhesive system of the invention onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

Still a further aspect of the invention concerns a wood based product obtainable by the method of the invention. Such a product comprises comprising wooden material and cured adhesive.

Still a further aspect of the invention concerns use of an adhesive system of the invention for joining one or more pieces of a wooden material with one or more further pieces of a material.

The term “adhesive system“ as used herein refers to a combination of components which function as and is intended to be used together as an adhesive. The components may be present in the same adhesive composition comprising all the components necessary for its function as an adhesive or in separate compositions, such as an adhesive composition and a hardener, functioning as an adhesive when combined. Such separate compositions may be mixed shortly before application to the surfaces to be joined or be applied separately to the surfaces. In the present invention, the resin component and the hardener component are usually kept separated and not mixed until during or shortly before use. The aqueous polymer dispersion may be included in the hardener component but may also be a separate component that is mixed with the other components during or shortly before use. The adhesive system of the invention is particularly useful for joining pieces of wooden materials.

The term “amino resin” as used herein refers to a condensation product of formaldehyde and at least one compound carrying $-NH_2$ or $-NH$ groups. Such compounds include, for example, urea and melamine and resins include, for example, UF, MF and MUF resins.

The term “urea based amino resin” as used herein refers to amino resins, such as UF and MUF, in which urea constitutes from 75 to 100 wt% for example from 90 to 100 wt% or from 95 to 100% of said at least one compound carrying -NH_2 or -NH groups. However, also other compounds comprising reactive nitrogen may be included at the preparation of the resins, such as NH_3 or hexamine.

MUF resins may be based on a mixture of a UF resin and a MUF resin prepared separately, but may also be a co-condensation product of melamine, urea and formaldehyde. Urea based amino resins of the kinds mentioned above are commercially available at various ratios between the constituents, for example between melamine and urea and between the amine and formaldehyde.

The term “F/NH_2 ratio” is commonly used in the art of amino resins for characterising the amount of formaldehyde compared to the amount of reactive nitrogen in the raw materials used for preparing the resin. The term as used herein refers to the molar ratio between formaldehyde and the sum of all nitrogen atoms except those in the ring structure of aromatic groups, such as in the ring structure of melamine, if used. Thus, even if written as “NH_2” most of the nitrogen in the final resin is not in the form of NH_2 and does further include also nitrogen originating from optional other reactive nitrogen containing groups in the raw materials of the resin. Further, most of the formaldehyde is reacted in the final resin, but the amount used can be determined after hydrolysing the resin. If urea is the only nitrogen containing compound used for the resin, the F/NH_2 is equal to ½ of the F/U ratio. The urea based amino resin of the present invention has an F/NH_2 molar ratio from 0.3 to 0.65, for example from 0.4 to 0.6 or from 0.45 to 0.6. The F/NH_2 molar ratio may also be from 0.45 to 0.55 or from 0.45 to 0.5.

The term dry content as used herein refers to the content of anything in the adhesive system or a component thereof not being water. The entire adhesive system may, for example, comprise from 20 to 70 or from 40 to 60 wt% water.

The term wooden material as used herein refers not only to solid wood, but also to materials such as fibre-, chip-, and particleboard materials. The surfaces to be joined may be of the same or different types of materials. The pieces of wooden material can be any type and form such as chips, fibres, sheets, laminas, veneers, board products etc. The invention is particularly favourable for joining veneers onto a substrate, such as a board

material like any one of such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board.

The resin component comprises a urea based amino resin and may, for example, be an aqueous solution thereof. The resin component, including any water therein, may, for example, comprise from 50 to 90 wt% or from 65 to 80 wt% of urea based amino resin.

The hardener component comprises at least one acid, acid generating salt or acidic salt and may, for example, be an aqueous solution thereof. Examples of acids include organic acids like carboxylic acids as well as inorganic acids. Specific examples of acids include formic acid, acetic acid, maleic acid, citric acid, glycolic acid, lactic acid, malic acid, tartaric acid, phosphoric acid, hydrochloric acid, sulphamic acid, sulphonic acid and para-toluene sulphonic acid. Examples of acid generating salts include ammonium salts such as ammonium chloride, ammonium sulphate and ammonium phosphate, as well as organic salts like ethylene diamine salts. Examples of acidic salts include metal salts such as acidic aluminium, zirconium, zink, magnesium and calcium salts, for example those that are water soluble of chloride, nitrate and sulphate, particularly aluminium salts like aluminium chloride, aluminium nitrate and aluminium sulphate. The concentration of acid, acid generating salt or acidic salt in the hardener component may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt%. The hardener component may further comprise additives used in the art such as fillers like kaolin, chalc, wood flour, coconut meal etc. Other possible additives include, for example, cellulose derivates like carboxymethyl cellulose (CMC) or hydroxyethyl cellulose (HEC). The dry content of the hardener component may, for example, be from 20 to 80 wt% or from 35 to 60 wt%.

The aqueous polymer dispersion comprise finely dispersed particle of at least one polymer, for example in an amount from 20 to80 wt% or from 30 to 70 wt% polymer in the aqueous dispersion. The polymer may, for example, be at least one synthetic polymer, such as homo- and co-polymers made from ethylenically unsaturated monomers like vinyl monomers. Examples of polymers include homo- or co-polymers of vinylacetate, homo or co-polymers of esters of (meth)acrylic acid, homo-or co-polymers of (meth)acrylamide, homo- or co-polymers of (meth)acrylic acid or homo- or co-polymers of vinyl alcohol. Further examples include and styrene-butadiene co-polymers. More specific examples of polymers include polyvinyl acetate (PVAc), polyethylene vinylacetate (EVA), co-polymers of vinylchloride and vinylacetate or ethylene vinylacetate, polyethylene-acrylic acid (PEAA), ethylene methyl acrylate copolymer (EMA), polyethyl methacrylate (PEMA), co-

polymers of vinylacetate and other esters, such as alkyl esters of (meth)acrylic acid, styrene acrylate co-polymers, and styrene-butadiene rubber (SBR). Further examples of polymers include polyurethane. Particularly useful polymers include at least one of PVAc and EVA, especially EVA. Many polymers useful for the invention are commercially available as aqueous dispersions or solutions. The polymers can also be prepared by general methods known to those skilled in the art.

The term “(meth)acryl” as used herein refers to both acryl and methacryl equally. For example, (meth)acrylate refers to any of acrylate or methacrylate while (meth)acrylic acid refers to any of acrylic acid or methacrylic acid.

In some embodiments the polymer is functionalised, i.e. comprises functional groups. Such groups include, for example, at least one of carboxylic acid, anhydrides thereof, N-alkylol, N-alkoxymethyl or glycidyl groups. Such groups may, for example be incorporated into the polymer by copolymerising at least one monomer comprising at least one such group with the other monomers. Examples of such monomers include acrylic acid, methacrylic acid, crotonic acid, isocrotonic acid, itaconic acid, itaconic anhydride, maleic acid, maleic anhydride, fumaric acid N-alkylol (meth)acrylamides such as N-methylol (meth)acrylamide and N-(alkoxymethyl) (meth)acrylates such as N-(butoxymethyl) (meth)acrylamide or N-(iso-butoxymethyl) (meth)acrylamide. However, the polymer may also be free from such monomers and particularly from monomers comprising groups that may release formaldehyde like N-methylol acrylamide.

Polymers mentioned herein, such a PVAc, refers both to functionalised and non-functionalised polymers, unless otherwise specified.

The average particle diameter of the dispersed polymer may, for example, be from 0.05 to 10 µm or from 0.1 to 5 µm. The weight average molecular weight M_w of the polymer may, for example, be from 100 000 to 4 000 000 or from 350 000 to 2 000 000.

In some embodiments the aqueous polymer dispersion is a separate component, for example comprising from 20 to 80 wt% or from 35 to 65 wt% of dispersed polymer particles. Such a separate component may be mixed with the hardener component and/or the resin component during or shortly before use of the adhesive system.

In some embodiments the aqueous polymer dispersion is included in the hardener component. The hardener component may then comprise at least one acid, acid generating salt or acidic salt as described above, usually dissolved in the aqueous phase, and dispersed polymer particles as described above. Such a hardener component may, for example, comprise from 0.1 to 10 wt% or from 1 to 5 wt% of acid, acid generating salt or acidic salt and from 20 to 80 wt% or from 35 to 65 of dispersed polymer particles. Examples of useful hardener components include those described in WO2001/070898, EP 0501174 and WO 2002/068178.

In some embodiments part of the polymer dispersion is a separate component and part of the dispersion is included in the hardener component.

The urea based amino resin usually comprise some free urea i.e. non-reacted urea, for example from 1 to 50 wt% or from 10 to 40 wt%, particularly from 15 to 35 wt% urea based on dry resin. However, in addition to the urea in the resin, the adhesive system of the invention comprises no or less than 0.9 wt% urea, for example less than 0.7 wt% urea or less than 0.5 wt% urea, particularly less than 0.3 wt% urea or less than 0.1 wt% urea, based on the total weight of the entire adhesive system.

The adhesive system is preferably free from or comprise less than 10 wt% of phenolic resin based on the amount of urea based amino resin, particularly less than 5 wt%, or less than 1 weight%.

Various ratios between the components in the adhesive system may be used. The amount of acid, acid generating salt and acidic salt in the adhesive system may, for example, be from 0.1 to 25 wt% or from 1 to 10 wt% of the amount of dry urea based amino resin. Further, the weight ratio of dry urea based amino resin to dry polymer in the adhesive system may, for example, be from 45:1 to 1:15, particularly from 15:1 to 1:7 or from 5:1 to 1:3.

An adhesive system of the invention may further comprise additives such as polyvinyl alcohol (PVA), surfactants, emulsifiers, protective colloids, preservatives, antifoaming agents, viscosity adjusting agents; fillers such as kaolin or calcium carbonate, protein, starch, coalescing agents such as at least one of butyl di(ethylene)glycol acetate, diethyleneglycol monobutyl ether, diethyleneglycol monomethyl ether, diethyleneglycol dibensoate, dipropyleneglycol dibensoate, propylenecarbonate and dimethyl esters of glutarate, adipate or succinate, and other additives known to be suitable for use in wood adhesive formulations, including combinations thereof. Such additives may be included in any of the components, such as in at least one of the resin component or the hardener component.

In a method of the invention the resin component and the hardener component of the adhesive system are applied to at least one surface of one or more pieces of a wooden material, either separately or after being mixed shortly before application, for example from 30 seconds to 8 hours or from 1 to 30 minutes before application. When the components are applied separately, they may be applied to the same or to two different surfaces to be joined. After application of the adhesive system, the pieces to be joined are pressed together. The pressing time depends on the wood based product intended to be produced and may, for example, be from 5 seconds to 15 minutes, particularly from10 seconds to 10 minutes or from 20 seconds to 3 minutes. Also the temperature of the press depends on the product to be produced and may, for example, be from 20 to 180°C, preferably from 40 to 130°C or from 50 to 100°C.

The pieces of wooden material may be joined to other pieces of the same or different kind of wooden material or to non-wooden material like plastics or paper, for example in foiling applications.

Some embodiments of a method of the invention comprise applying the adhesive system onto a sheet-like material, and joining it with a further sheet-like material. The term sheet-like material as used herein refers to materials having dimensions in either the length or width directions, or both, that are much greater than the dimension of the material in the thickness direction; exemplary of sheet-like materials include lamellae, boards, veneer, and the like. For example, it is possible to make products by form pressing or to make products in which two or more different kinds of wood are joined, which is common in, for example, parquet flooring.

Some embodiments of the invention comprise applying the adhesive system onto a wooden board material, such as board of solid wood, particle board, fibre board (e.g. MDF or HDF), chip board or oriented strand board, and joining the wooden material with another kind of material such as foils of paper or plastic materials.

A wood based product of the invention may, for instance, be a laminated or veneered material, such as laminated flooring, veneered flooring such as parquet flooring, a veneered furniture material, plywood (including curved plywood), wall panels, roofing panels, laminated beams.

The invention is further illustrated by means of the following non-limiting examples. Unless otherwise stated, parts and percentages refer to parts by weight and percent by weight, respectively.

Example 1

Three UF resins with different F/NH_2 were tested with four different hardeners.

Resin A: Molar ratio F/NH_2 = 0.6; dry content 66 wt%

Resin B: Molar ratio F/NH_2 = 0.5 dry content 71 wt%

Resin C: Molar ratio F/NH_2 = 0.45 dry content 70 wt%

The compositions of Hardeners 1-3 are shown in Table 1 below:

Table 1. Composition of Hardeners 1-3.

Ingredient	**Hardener 1**	**Hardener 2**	**Hardener 3**
Aqueous 55% EVA dispersion Vinnapas™ EP441	84.5%		
Aqueous 52% PVAc dispersion Vinac™ DPN-36		84.4%	
Aqueous 60% PVAc dispersion Mowilith™ DHSS3			78.6%
Aqueous $AlCl_3$ (28%)	15.3%	15.4%	15.3%
Water			5.9%
Other (colour, defoamer)	0.2%	0.2%	0.2%
Total concentration $AlCl_3$	4.3%	4.3%	4.3%
Total dry content	50.7%	48.2%	51.5%

Hardener 4 is based on WO 2007/040410 and is a mixture of Hardener I in Table 2 therein and Modifier 2 in Table 3 therein. Thus, a first composition was prepared from 4.0% aluminium chloride-6-hydrate, 4.0% mono ammonium phosphate, 2.2% polypropylene glycol, 37.4% resorcinol, 0.2% defoamer and colour, 0.45% xanthan gum, 5.0% lactic acid and 46.75% water. Further, a second composition was prepared from 65.9% Vinac DPN-36, 21.6% urea and 12.5% water. Then 13.3 parts of the first composition was mixed with 18.5 parts of the second composition. Using 31.8 parts of Hardener 4 with 100 parts UF resin thus corresponds to Mixture 6 in Table 3 of WO 2007/040410.

A press time study was performed with various combinations of the three resins A, B and C and the Hardeners 1-3. As a comparison trials were also made with Hardener 1 + 6% urea (referred to as 1U).

In the study pieces of 0.6 mm beech veneer were glued onto a particle board and pressed in a carver press with 5 x 0.6 mm pieces beech veneer creating a 3 mm distance to the press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C) and the strength of the bonds were evaluated when the glued constructions had reached room temperature (referred to as cold). The veneer was pulled off from the particle board by hand and the amount of fibre tear from the board on the veneer was estimated. Normally at least 80% fibre tear cold is required for passing the test, but lower values can be acceptable if the bond is strong. The press time refers to the shortest press time that could be used and still achieving sufficient bond strength for passing the test. The press times in minutes and seconds for the different combinations are shown in Table 2 below:

Table 2. Press times

Resin	Hardener	Ratio	Press time	Amount urea in the system$^{1)}$
A	1	100:50	1'30"	
A	1	100:75	1'15"	
A	1	100:100	1'	
A	2	100:50	1'30"	
A	2	100:75	1'15"	
A	2	100:100	1'	
A	3	100:50	1'30"	
A	3	100:75	1'15"	
A	3	100:100	1'	
A	1U	100:50	2'30"	2%
A	1U	100:75	2'30"	2.6%
A	1U	100:100	2'30"	3%
A	4	100:31.8	Did not pass	3%

Resin	Hardener	Ratio	Press time	Amount urea in the system[1]
B	1	100:50	4'	
B	1	100:75	2'30"	
B	1	100:100	2'30"	
B	2	100:50	4'	
B	2	100:75	2'30"	
B	2	100:100	2'30"	
B	3	100:50	3'30"	
B	3	100:75	2'30"	
B	3	100:100	2'30"	
B	1U	100:50	7'	2%
B	1U	100:75	4'	2.6%
B	1U	100:100	2'30"	3%
B	4	100:31.8	Did not pass	3%
C	1	100:50	6'	
C	1	100:75	4'30"	
C	1	100:100	3'	
C	2	100:50	6'	
C	2	100:75	5'	
C	2	100:100	4'	
C	3	100:50	6'	
C	3	100:75	5'	
C	3	100:100	3'	
C	1U	100:50	10'	2%
C	1U	100:75	6'	2.6%
C	1U	100:100	6'	3%
C	4	100:31.8	Did not pass	3%
C	4	100:63.6	Did not pass’	5%

[1] Refers to urea in addition to what may be present in the UF resin.

It appears that addition of urea increased the press time. Further, Hardener 4 could not be used at all for gluing with resins B and C having the lowest F/NH_2 ratio.

Example 2

In order to further investigate the differences between the hardeners additional pressings were performed with resin A. The ratio glue/hardener was 100:100 and press times were fixed to 20 and 30 seconds, respectively. The material used was 0.6 mm birch veneer on a HDF board in a carver press (glue spread 120 g/m^2, pressure 0.9 MPa, press temperature 90°C). The quality of the glue line was evaluated by estimation of bond strength when the glued construction had reached room temperature. The veneer was pulled off from the HDF by hand and the amount of fibre tear from the board on the veneer was estimated.

Table 3. Fibre tear

Resin	Hardener	Ratio	Press time	Fibre tear	Amount Urea in the system[1)]
A	1	100:100	20"	80%	
A	1	100:100	30"	80%	
A	2	100:100	20"	70%	
A	2	100:100	30"	60%	
A	3	100:100	20"	60%	
A	3	100:100	30"	50%	
A	1U	100:100	20"	30%	3%
A	1U	100:100	30"	50%	3%

1) Refers to urea in addition to what may be present in the UF resin.

It appears that Hardener comprising EVA gave the best result, except when urea was added.

Example 3

The formaldehyde emission for some combinations were evaluated according to the standard JAS MAFF 233 (Pressing temperature: 90˚C; Pressure: 0.8 MPa; Material: 10 beech veneers 1.5 mm; Glue spread 160 g/cm3; Pressing times 8, 10 or 12 minutes). The results are shown in Table 4 below:

Table 4. Formaldehyde emissions

Resin	Hardener	Ratio	Emission (mg/l)
A	1	100:40	0.7
B	1	100:40	0.2
C	1	100:40	0.1
A	2	100:40	0.9
B	2	100:40	0.2
C	2	100:40	0.1
A	3	100:40	1.1
B	3	100:40	0.2
C	3	100:40	0.1
A	4	100:31.8	0.2

CLAIMS

1. Adhesive system comprising
   a. a resin component comprising a urea based amino resin having an F/NH_2 ratio from 0.3 to 0.65;
   b. a hardener component comprising at least one acid, acid generating salt or acidic salt; and,
   c. an aqueous dispersion of at least one polymer;

wherein the adhesive system comprises no or less than 0.9 wt% of urea, based on the weight of the entire adhesive system, in addition to any urea present in the urea based amino resin.

2. Adhesive system as claimed in claim 1, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.4 to 0.6.

3. Adhesive system as claimed in claim 2, wherein the urea-formaldehyde resin has an F/NH_2 ratio from 0.45 to 0.55.

4. Adhesive system as claimed in any one of the claims 1-3, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no or less than 0.5 wt% of urea, based on the total weight of the entire adhesive system.

5. Adhesive system as claimed in claim 4, wherein the adhesive system, in addition to any urea present in the urea based amino resin, comprises no urea.

6. Adhesive system as claimed in any one of the claims 1-5, wherein the at least one polymer comprises at least one homo- or co-polymer made from ethylenically unsaturated monomers.

7. Adhesive system as claimed in claim 6, wherein the at least one polymer comprises at least one homo- or co-polymers of vinylacetate.

8. Adhesive system as claimed in claim 7, wherein the at least one polymer comprises at least one of polyvinyl acetate (PVAc) or poly ethylene vinylacetate (EVA).

9. Adhesive system as claimed in claim 8, wherein the at least one polymer comprises poly ethylene vinylacetate (EVA).

10. Adhesive system as claimed in any one of the claims 1-9, wherein the hardener component comprise at least one aluminium salt.

11. Adhesive system as claimed in any one of the claims 1-10, wherein the amount of acid, acid generating salt and acidic salt in the adhesive system is from 0.1 to 25 wt% of the amount of dry urea based amino resin.

12. Adhesive system as claimed in any one of the claims 1-11, wherein the weight ratio of dry urea based amino resin to dry polymer in the adhesive system is from 45:1 to 1:15.

13. A method of producing a wood based product, comprising applying an adhesive system according to any one of the claims 1-12 onto at least one surface of one or more pieces of a wooden material, joining the one or more pieces with one or more further pieces of a material and pressing the pieces together.

14. Wood based product obtainable by the method according to claim 13.

15. Use of an adhesive system according to any one of the claims 1-12 for joining one or more pieces of a wooden material with one or more further pieces of a material.