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(54) Title: RESIN IMPREGNATED OVERLAY

(57) Abstract: The invention relates to a resin impregnated overlay for application to the surface of a solid substrate, preferably a wood based substrate. The resin impregnated overlay comprises kraft paper, the kraft paper being printed on at least one side before resin impregnation, wherein the printed kraft paper is saturated with between 25 and 50% by weight of a resin and cured to leave residual volatiles of less than 2.5%. The overlay is compatible with paint, especially water based paints and has improved color properties. The invention further relates to a process for the manufacture of the resin impregnated overlay according to the invention, to a method for preparing a painted substrate and to substrates covered with the overlay, optionally painted.



WO 2010/122078 A1

**Resin Impregnated Overlay**

[001] The invention relates to a resin impregnated overlay for application to the surface of a solid substrate, preferably a wood based substrate. The overlay is compatible with paint, especially water based paints and has improved color properties. The invention further relates to a process for the manufacture of the resin impregnated overlay according to the invention, to a method for preparing a painted substrate and to substrates covered with the overlay.

[002] In applications of painting wood-based products, many types of paints, especially water-based paints, are undesirable because they can cause fiber raise. But for environmental and toxicity reasons, water-based paints are preferable to paints containing volatile organic compounds. Furthermore, the surfaces of wood-based products are not always suitably smooth for direct painting if they have knots, cracks and extracts, causing poor appearance and defects.

[003] To overcome this, some applications use wood products overlaid with colored high resin content saturated papers. The resins used in the overlays can be pigmented or unpigmented phenolic resins. But these products are not preferred for outdoor applications because phenolic resins are not UV-stable. Thus melamine resins are better suited for outdoor applications, but they are more prone to cracking upon swelling and shrinkage of wood fibers, for example, under humid conditions. Additionally, these resin saturated papers are not paintable after hot pressing.

[004] Paper overlays are often used to improve the surfaces of wood based substrates, including plywood, LVL, particle board, medium- and high- density fiberboard, and oriented strand board (OSB). Overlays provide significant advantages over bare wood products by improving the surface of the wood products, making it more smooth and uniform and providing a suitable surface for painting.

[005] For example, U.S. Patent No. 5,955,203 discloses an overlay manufactured with unbleached kraft paper impregnated with a phenolic thermosetting resin, which is dried and fully cured (C-stage). Unbleached kraft paper makes an excellent overlay material because of its high strength, low cost, and good resin absorbance, which allows for good resin saturation. However, a significant drawback for using kraft paper is its brown color, which distorts the colors of paints applied to the overlay. This is less important in the concrete form application disclosed in 5,955,203, but it is of critical importance in other applications, such as signage.

[006] DE 102006007038 describes overlays for coating substrates and describes to overcome the problem of the brown color of kraft paper overlays by using printed kraft paper and impregnating with one or more layers of pigmented resin in the overlay, but this approach does not result in sufficiently good color appearance. This document does not deal with providing an overlay having good paintability and the resulting overlays are not readily paintable.

[007] Alternatively, others have used resin impregnated decorative paper, manufactured from bleached pulp with a high quantity (up to 45% measured as ash content) of pigments and fillers. But decorative paper has a higher cost and poor strength and low porosity compared to kraft paper because of the high pigment and filler loading. Due to the high ash content of decorative paper, it is more prone to cracking in the final product. Furthermore, the decorative paper can have poor paint adhesion in the final overlay product.

[008] Accordingly there still exists a desire for a resin impregnated overlay that does not have at least one of the mentioned disadvantages. In particular there is a desire for a resin impregnated overlay that has a high strength like overlays based on Kraft paper, but that is easily paintable unlike the known kraft paper based overlays.

[009] According to the invention there is provided a resin impregnated overlay comprising kraft paper with a weight between 60 and 300 g/m<sup>2</sup>, the kraft paper being printed on at least one side before resin impregnation, wherein the printed kraft paper is saturated with between 25 and 50% by weight of a resin and cured to leave residual volatiles of less than 2.5%.

5 [0010] The present invention overcomes many of the problems with the prior art by allowing the use of kraft paper in paintable overlays without distorting the color of paint on the top coat, and without requiring bleaching of the kraft paper or a primer coat. Furthermore, the present invention allows more flexibility than the primer coat solution because multiple colors can be used on the same overlay. The methods of the invention allow manufacturing of uniform,  
10 paintable, and aesthetically preferred resin saturated papers without requiring investment in primer application equipment and without the expense of primers and at a lower cost than those made with decorative papers.

[0011] The inventors believe that the good paintability is a result of the high porosity and that good paintability is achieved by impregnating the kraft paper with a relatively low amount of  
15 resin (25 and 50% by weight relative to the total weight of the overlay) and curing, preferably before application to a substrate, to a high degree as characterized by a residual volatiles content of less than 2.5%, resulting in that the overlay is porous and remains porous also on application of the overlay on the substrate, in particular when pressure is applied to bond the overlay on the substrate.

20 [0012] The invention also relates to a method for making a resin impregnated overlay according to the invention comprising the steps of: printing kraft paper with a weight between 60 and 300 g/m<sup>2</sup> on at least one side with ink; saturating the kraft paper with between 25 and 50% by weight

of a resin; and curing the resin to leave residual volatiles of less than 2.5% and optionally painting the overlay. This overlay can then be used on any suitable surface for example by applying a glue layer and hot-pressing the overlay to the substrate surface, with the printed side facing outward (facing away from the substrate). The overlay is preferably painted after adhering  
5 the overlay to the substrate.

[0013] The kraft paper can be any kraft paper suitable for use as an overlay, for example, having a basis weight of between 60 and 300 g/m<sup>2</sup>, preferably between 140 and 160 g/m<sup>2</sup>. While the Kraft paper can be bleached, this adds costs but brings limited benefits of lighter colored substrates. As the advantages of the invention are particularly apparent in unbleached kraft  
10 paper, it is preferred to use unbleached kraft paper.

[0014] In the overlays of the invention, kraft paper is printed with between 5 and 50 g/m<sup>2</sup>, preferably 5-30, more preferably 5-25 and most preferably 5-20 g/m<sup>2</sup> of a suitable ink. The lower limit on the ink quantity for any particular paper is determined by how much ink is required for adequate coverage to achieve the desired color. The upper limit is limited by the  
15 porosity of the paper after printing because too much ink can possibly interfere with resin saturation. The kraft paper is printed implies that substantially the whole surface of the kraft paper is covered with a layer of ink such as to cover and hide the brown color of the kraft paper.

[0015] Preferably the ink is light gray, although any color may be used, and the printing process may even involve colored patterns, if desired. The paper may be printed on both sides, but this  
20 adds cost with little benefit because one side of the overlay is applied to a solid substrate and this is not visible.

[0016] In a preferred embodiment, the kraft paper is printed with gray ink using any printing technology known in the art for printing on kraft paper, preferably flexo printing. Any ink known in the art that is useful for printing on kraft paper may be used, particularly those typically used for printing logos on kraft paper, for example, the Woodline set of inks from Flint Group. Preferably, the ink used for printing is UV-stable and does not interfere with resin saturation. Water based inks are preferred.

[0017] After application of the ink, the printed kraft paper is saturated with resin. The resins used with the invention are preferably phenol formaldehyde (PF) resins, melamine formaldehyde (MF) resins, or mixtures thereof or co-condensed resins. Preferably, in the overlay according to the invention, the resin is a mixtures or co-condensation product of PF and MF resins, wherein the mole percent of phenol (relative to the total mole of melamine and phenol) is between 20 and 80%, preferably between 30 and 70% and most preferably between 40 and 60 %. It was found that this mixed or co-condensated resin provides better painting properties in combination with good mechanical properties. In particular, the mixed or co-condensated resin provides good adhesion, is less dark than PF resin, is less brittle than MF resin and is moisture resistant and can hence be coated without particular problems with water based paints.

[0018] The resin content in the overlay is between 25 and 50% by weight (relative to the total weight of the overlay), preferably between 25 and 47%, more preferably between 25 and 45%, even more preferably between 25 and 40% and most typically is 28 – 35%. The resin content and type are selected so that the surface of the overlay remains porous while still allowing a high enough degree of internal bonding. The porosity has been found to relate to paintability. Paintability means that the surface has sufficiently high adhesion of a paint layer on the overlay.

The paint adhesion can be determined by measuring the paint adhesion strength using methods known in the art (for example peel strength).

[0019] The amount of resin depends on the choice of the type of kraft paper, resin, and particular envisaged application. Too high a resin content produces a non-porous surface which is not readily paintable without special treatment before painting. The skilled person can easily determine the optimum amount of resin for a given choice of paper and resin to achieve on one hand sufficient strength and on the other hand sufficient porosity for paintability. It was found that with pure PF resin, about 30wt % (+/-10 wt%) resin content is acceptable. For the preferred resin mixtures or co-condensation product of PF and MF resins, the amount is preferably 40 wt% +/- 10 wt%.

[0020] For environmental reasons, water based resins are preferred, but co-solvents and solvent based resins may also be used. Urea formaldehyde (UF) resins may also be used where moisture resistance is not required. The resin should be selected to provide high internal bond strengths in saturated paper with low resin content. Additives to the resin may be used, although they are not required.

[0021] Dyes and pigments may be used but are not required because the required color and opacity comes from the ink layer printed directly on the kraft paper. A small quantity of a dye or pigment may improve the appearance of the overlay without significantly impacting the performance of the resin. Preferably, the amount of pigments in the resin is less than 3 wt%, more preferably less than 2 wt%, even more preferably less than 1 wt% and most preferably substantially 0 wt%.

[0022] Flexibilizers typically used with PF or MF resins may be used as is routine. Adhesion promoters may be used to aid in the adhesion of paint on the final overlay, although in practice this should not be necessary since the products of the invention retain good paint adhesion. Curing catalysts may be used, if desired, depending on resin type and formulation used, preferably a blocked acid catalyst for MF resins, PF/MF blends or PMF co-condensed resins.

[0023] The resin impregnated printed kraft paper is dried and fully cured so that it does not melt or flow during later hot pressing. The cure level is expressed as the measured percent volatile content is below 2.5%, preferably 1.5% to 2%. The volatile content in % is calculated as follows:  $(m1-m2)/m1$  [%], in which  $m1$  = weight of the impregnated paper (before drying in a thermostat),  $m2$  = weight of the impregnated paper after drying in a thermostat at 160 °C for 5 min.

[0024] The dried and fully cured overlay may then be applied to a substrate surface in the usual manner. In most cases, the overlay is bonded on panels in hot presses. The overlay can be applied with a separate glue line, glue film, or liquid glue. A glue line is a semi-dried glue line applied directly onto one side of the overlay or substrate. Glue film is a resin saturated paper especially designed for bonding in hot presses.

[0025] The invention also relates to a method for preparing a painted substrate comprising adhering on at least one surface of the substrate an overlay according to the invention and painting the outer surface of the overlay before or after adhering the overlay and to painted substrate, preferably a wood based substrate, obtainable according to said method. The invention also relates to an overlaid substrate, for use in the above method, which comprises a substrate and adhered on at least one surface thereof an overlay according to the invention.



[0026] One advantage of the overlay according to the invention is that less or no primers are needed to achieve good paint adhesion. In some applications however, the properties of an overlay may be further enhanced by applying a primer to the top surface of the saturated paper. Primers consist of pigments, fillers, binder, and solvents. The primer is applied during the overlay manufacturing process after the kraft paper is saturated with resin. The primer is fully dried and cured to provide a porous, uniform surface for further processing. Primers can be of any color, but typically light gray is used because it is aesthetically favorable, providing good hiding characteristics of the brown kraft paper color so that the top coat colors are not distorted. There are several disadvantages with using a primer, however, including the high cost of the primer, the complicated manufacturing process, and the costs of investment in the necessarily application equipment in the impregnation machine. Therefore, in a more preferred embodiment no primer is used on the overlay and the paint is directly applied on to the overlay.

#### **EXAMPLE**

[0027] Saturating grade kraft paper with a weight of 150 g/m<sup>2</sup> is printed with 10 g/m<sup>2</sup> of light gray printing ink. The paper is saturated with a 50% by weight mixture of phenol and melamine formaldehyde resins to a resin content of 40% by weight, giving a total weight of 265 g/m<sup>2</sup> after drying and fully curing. The saturated paper is dried to leave residual volatiles of 2%, measured at 160°C for 5 minutes.

What is claimed is:

1. A resin impregnated overlay comprising kraft paper with a weight between 60 and 300 g/m<sup>2</sup>,  
the kraft paper being printed on at least one side before resin impregnation, wherein the  
printed kraft paper is saturated with between 25 and 50% by weight of a resin and cured to  
5 leave residual volatiles of less than 2.5%.
2. The resin impregnated overlay of claim 1, wherein the kraft paper is printed with between 5  
and 20 g/m<sup>2</sup> of ink before resin impregnation.
3. The resin impregnated overlay of claims 1-2, wherein the weight of the kraft paper is  
between 140 and 160 g/m<sup>2</sup>.
- 10 4. The resin impregnated overlay of claims 1-3, wherein the resin is substantially pigment free.
5. The resin impregnated overlay of claims 1-4, wherein the resin is a phenol formaldehyde or  
melamine formaldehyde resin or, more preferably, a mixture or co-condensate thereof.
6. The resin impregnated overlay of claim 5, wherein the resin is a mixture or co-condensate of  
phenol formaldehyde and melamine formaldehyde resin wherein the mole percent of phenol  
15 (relative to the total mole of melamine and phenol) is between 20 and 80%, preferably  
between 30 and 70 % and more preferably between 40 and 60 %.
7. A method for making a resin impregnated overlay according to claims 1- 6, comprising the  
steps of:
  - a. printing kraft paper with a weight between 60 and 300 g/m<sup>2</sup> on at least one side  
20 with ink;

- b. saturating the kraft paper with between 25 and 50% by weight of a resin; and
  - c. curing the resin to leave residual volatiles of less than 2.5%,
  - d. optionally painting the overlay .
8. A method for preparing a painted substrate comprising adhering on at least one surface of the
- 5 substrate an overlay according to any one of claims 1 – 6 and painting the outer surface of the overlay before or after adhering the overlay.
9. An overlaid substrate for use in the method according to claim 8, comprising a substrate having adhered on at least one surface thereof an overlay according to any one of claims 1 – 6.
- 10 10. A painted substrate, preferably a wood based substrate, obtainable according to claim 8.

# INTERNATIONAL SEARCH REPORT

International application No  
PCT/EP2010/055304

**A. CLASSIFICATION OF SUBJECT MATTER**  
INV. D21H27/26

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)  
D21H

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

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                                                                           | Relevant to claim No. |
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| -/--      |                                                                                                                                                              |                       |

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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**C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT**

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2010/055304

| Patent document<br>cited in search report |    | Publication<br>date | Patent family<br>member(s)                                                                                                                                                                            | Publication<br>date                                                                                                                                                  |
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