WO 2008/078003 A1

Title: WOOD PANEL AND METHOD FOR MAKING THE SAME

Abstract: The invention relates to a wood panel formed of a number of veneer layers, and a method for making it. In accordance with the invention, a thermoplastic material of adhesive quality is arranged between predetermined veneer layers, and the veneer layers are arranged against each other and joined together by means of the thermoplastic material, heat and pressure, to provide a wood panel.
WOOD PANEL AND METHOD FOR MAKING THE SAME

FIELD OF THE INVENTION

The invention relates to a wood panel formed of a number of veneer layers as defined in the preamble of claim 1, and to a method for making a wood panel as defined in the preamble of claim 9.

BACKGROUND OF THE INVENTION

Known from prior art are different kinds of wood panels, e.g. plywoods, veneer plates or the like.

Known from prior art is the use of phenol- and urea-based glues and derivatives thereof as adhesives in the manufacture of wood panels, and specifically plywood. Also known is to glue coating layers on top of the veneer layers with a polyurethane or phenolic glue.

The problem with the known bent wood panel products is the build-up of tension on the bent part, which may cause tearing of the veneers.

OBJECTIVE OF THE INVENTION

The objective of the invention is to eliminate the drawbacks referred to above. A further objective of the invention is to disclose a new type of wood panel and a method for making it. One specific objective of the invention is to disclose a wood panel that is easily shaped.

SUMMARY OF THE INVENTION

The wood panel and the method for making it in accordance with the invention are characterized by what has been presented in the claims.
The invention is based on a wood panel that is formed of a number of veneer layers. In accordance with the invention, thermoplastic material of adhesive quality is arranged between predetermined veneer layers, and the veneer layers are arranged against each other and joined together with the thermoplastic material, heat and pressure, to provide a wood panel.

The invention is specifically based on the idea that a thermoplastic material having certain qualities, preferably without any phenol content, is used as the material which glues the veneer layers together. Furthermore, the same material can be used for coating the wood panel. Besides virgin materials, by-products from other processes and waste and recycling materials can be used in the invention, both for gluing and surface treatment. The invention is also based on the idea of providing a wood panel that has better bending qualities, e.g. for use in the furniture industry.

In this context, a wood panel refers to any wood panel product, plywood product, composite product, beam, pressed panel product or the like, formed of a number of layers, preferably veneer layers, and principally of wood-based materials, in which the layers are laid one upon the other and glued together.

In this context, a veneer layer refers to any layer of material, typically a thin layer of material, used for forming a layered panel. The layer of material may be formed of a wood-based material or other material suitable for the application.

In one embodiment, all veneer layers are substantially formed of the same material. In an alternative embodiment, at least one veneer layer is formed of a different material than the other veneer layers.

The wood panel may comprise veneer layers of varying thickness. The veneer layers can be arranged in
the desired array, i.e. in the transversal or longitudinal direction in the desired order.

In one embodiment of the invention, the thermoplastic material is arranged on the surface of at least one veneer layer. In one embodiment, the thermoplastic material is arranged on one surface of a veneer layer. In an alternative embodiment, the thermoplastic material is arranged on both surfaces of a veneer layer.

In one embodiment of the invention, the thermoplastic material is arranged on the surface of the topmost veneer layer, i.e. on the surface of the wood panel, to provide a coating. In one embodiment, one layer of the thermoplastic material is arranged on the surface of the wood panel to form a surface film. In another embodiment, at least two layers of the thermoplastic material are arranged on the surface of the wood panel to form two surface films. In this case, the desired company or product logo, product description or the like can be arranged under the surface film or between the surface films, e.g. in the form of a normal paper printout.

The surface of the wood panel is easily cleaned and kept clean due to the coating arranged on the surface of the wood panel.

The coating can function as an adhesive surface when reheated. In one embodiment, a desired design can be provided on the coating.

In one embodiment, the wood panel comprises a surface veneer layer substantially formed of a different material than the other veneers of the wood panel. The surface veneer is joined to the other veneers with the thermoplastic material in accordance with the invention.

In one embodiment of the invention, the thermoplastic material comprises a thermally behaving
thermoplastic agent of adhesive quality. The adhesive quality can be activated by heating and/or cooling. In one embodiment, the thermoplastic material also comprises other elements besides the thermoplastic agent, e.g. filler, paper, metal, additive or other such agents. In one embodiment, the thermoplastic material comprises a virgin thermoplastic agent. In a second embodiment, the thermoplastic material comprises a re-cycled thermoplastic agent. In a third embodiment, the thermoplastic material is a by-product from an industrial process, e.g. a waste product from a process shutdown or start-up. In a fourth embodiment, the thermoplastic material is a waste material used because of the adhesive qualities of a thermoplastic agent included therein. Among waste materials, e.g. adhesive laminate waste comprising a material based on wood fibres and a synthetic polymer as the thermoplastic agent, can be used.

In one preferred embodiment of the invention, the melting temperature of the thermoplastic agent is below 200°C, preferably below 180°C, more preferably below 170°C. In one embodiment, the melting temperature of the thermoplastic agent is between 90 and 170°C. The wood panel cannot be shaped at too high a temperature, which sets limits to the selection of the thermoplastic material and agent.

In one embodiment of the invention, the thermoplastic agent is a thermosetting plastic. In one embodiment, the thermosetting plastic is selected from the group of: polyethene, polypropene, derivatives thereof, mixtures thereof and other such thermosetting plastics with the melting temperature below 200°C, preferably below 180°C, and having the suitable qualities.

The thermoplastic material may be in the solid form, such as in the form of granulates, film,
shred or the like, in the melt form, solution form or dispersion form, e.g. a thermoplastic aqueous dispersion of polyethylene or polypropene. The thermoplastic material in the dispersion form can also be foamed. In one embodiment, the thermoplastic material is in the form of a non-reactive hot-melt glue that can be re-shaped.

Layers of the thermoplastic material of varying thickness can be arranged between and onto the veneer layers, depending on the embodiment. The layer thickness of the thermoplastic material may vary depending on the properties of the thermoplastic material and the application of the wood panel. The thermoplastic material can be used to smooth out the flaws and irregularities of the veneer layers, also those occurring on the topmost veneer layer.

The thermoplastic material provides a plastic layer and forms a mechanical bond between the veneers. The thermoplastic material provides a strong and colourless bond without any phenol content. The same thermoplastic material can also be used as the coating.

In one embodiment of the invention, the wood panel is arranged as a straight panel. In another embodiment, the wood panel is arranged as a bent and shape-product, preferably by reheating the straight panel and shaping it into the desired shape. As the thermoplastic bond melts, it allows the veneers to glide relative to each other, thus enabling the bending without producing any tension to the structure. As the wood panel is cooled, it becomes rigid and holds its shape.

Furthermore, the invention is based on a method for making a wood panel, wherein the wood panel is formed of a number of veneer layers. In accordance with the invention, a thermoplastic material of an adhesive quality is arranged between predetermined veneer
layers, the veneer layers are laid one upon the other, and the veneer layers are joined together by means of the thermoplastic material, heat and pressure.

In one embodiment of the invention, the thermoplastic material is arranged between the veneer layers in the solid form, melt form, or in the form of a dispersion or solution. In one embodiment, the thermoplastic material is arranged between the veneer layers in the form of an aqueous solution or dispersion that is easily processed.

In one embodiment of the invention, the veneer layers are glued together by means of the thermoplastic material. In conjunction with gluing, the thermoplastic material is heated and cooled, and the veneer layers are pressed against each other to provide a wood panel. The thermoplastic material can be heated before arranging it between the veneer layers, or substantially in conjunction with arranging it between the veneer layers. Cooling can be performed before, in conjunction with and/or after the pressing.

In one embodiment of the invention, the thermoplastic material is heated to the melting temperature of the thermoplastic agent included therein to glue the layers together, and cooled below the melting point of the thermoplastic agent.

The wood panel can be made using apparatuses and methods known per se. Laying the layers one upon the other, joining them together and other typical steps in making the wood panel can be performed in any manner known per se in the art. Arranging the thermoplastic material between and on the surface of the veneers can be performed e.g. using the extruder technique, film technique, spraying technique, dispersion or foam application technique, roll application technique, cylinder application technique, shred application technique, coat and multi-layer coat application
technique, all known per se, their combinations or a corresponding technique. The veneers can be joined together e.g. using the hot pressing technique.

In one embodiment, heating the thermoplastic material, cooling it and/or pressing the veneer layers against each other are performed in the same process step. Alternatively, the above-mentioned steps can be performed as separate process steps.

In one embodiment, heating the thermoplastic material, cooling it and pressing the veneer layers against each other are performed in a hot pressing process or continuous pressing process. In one embodiment, cooling is performed under pressure.

The temperatures and pressure parameters used for heating and joining the veneers together depend on the thickness of the wood panel and the veneers, on the thermoplastic agent used and on its properties.

In one embodiment of the invention, the thermoplastic material is arranged on the surface of the topmost veneer layer to provide a coating. The coating can be provided in the same process step in conjunction with making the wood panel, or alternatively in a different step.

In one embodiment of the invention, a straight panel is formed in the manner described above.

In one embodiment of the invention, a straight wood panel is formed first, after which the straight wood panel or a part thereof is arranged into a desired shape to form a bent wood panel product. In one embodiment, the bent wood panel product is made by first forming a straight wood panel which is cooled, if desired, and/or cut into articles of a specific size, if desired. The wood panel or the article cut off therefrom is heated, bent into the desired shape by form pressing, and cooled to room temperature dur-
ing the form pressing. In this case, the veneers will glide relative to each other, providing a strong bend without any tension. In a preferred embodiment, the wood panel or a product cut off therefrom is heated just above the melting point of the thermoplastic agent and cooled quickly back below the melting point.

When making either a straight wood panel or a product bent to shape, grinding and other treatment processes of the wood panel can be performed on the straight panel before the possible bending, which facilitates the making of the wood panel, and specifically a pressed-to-shape article.

The shaping temperatures and times depend on the veneers used, their thickness and the thickness of the wood panel, and the thermoplastic material used and its properties, specifically the melting temperature. In shaping, one must avoid too long or too short heating times and too high or low temperatures.

The wood panel in accordance with the invention can be shaped by reheating the panel. In this manner, the panel can be shaped in the desired location at the desired time, e.g. on the customer's premises.

If desired, the thermoplastic material can be coloured. In this case, a coloured plastic layer between the veneers, or a coloured coating, is provided.

The wood panel in accordance with the invention is suitable for various applications. The wood panels in accordance with the invention can be used as interior panels, such as wall and ceiling panels, bathroom panels, specifically coated bathroom panels, building boards, floor bases, products arranged into shape, thermally shaped panels, protective package boards, and in products for the furniture industry and the like.

The thermoplastic material provides a strong, but at the same time flexible and phenol-free bond be-
tween the veneers. The bond between the veneers can be processed by means of heat. Flaws and irregularities on the surface of the veneer can be filled with the thermoplastic material. The gluing in accordance with the invention is also suitable for use on rough and irregular surfaces.

The thermoplastic material provides a plastic, waterproof layer between each veneer layer. It therefore functions as a moisture barrier material. Furthermore, arranging the thermoplastic material as the coating provides a protective and moisture-proof surface for the wood panel.

The invention provides good bending properties for the wood panel, because the veneers glide relative to each other during the thermally performed bending. The wood panels are easily bendable, without the veneers breaking at the bending sites, because no tension is created.

The invention provides the advantage that by using the thermoplastic material, it is possible to provide a transparent seam between the veneer layers. This is an advantage e.g. in laser cutting. Alternatively, the thermoplastic material can be coloured, if desired.

DETAILED DESCRIPTION OF THE INVENTION

In the following section, the invention will be described with the aid of detailed exemplary embodiments.

The wood panels used in the tests were prepared using 1.47mm birch veneers and 2.6mm spruce veneers. The veneers were made into 12 birch veneer and 12 spruce veneer wood panels, each having 7 veneer layers and the size of 600 x 600mm. The thickness of the birch veneer wood panels was 9mm and the thickness of the spruce veneer wood panels was 18mm.
Example 1

In this example, the thermoplastic material used was a polyethene film. The polyethene used can be a by-product from a process, recycling polyethene or virgin polyethene.

In this test, polyethene films in which the amount of polyethene was 90, 180 and 270g/m² were used. A polyethene film was arranged between each veneer layer to function as the adhesive agent. The films were hot pressed between the veneers such that the temperature was increased above the melting point of the polyethene, -106°C, so that the films would melt forming a mechanical bond between the veneers and joining the veneers to each other by means of the polyethene. Cooling back below the melting point of the polyethene was performed under pressure such that the veneer layers would adhere to each other. The pressure time used was 15min, wherein 5min comprised the heating step to increase the temperature to 160°C, and 10min comprised the cooling step to cool the temperature to about 70 - 90°C. The pressure used for the entire duration of the pressing was 1 MPa.

Moreover, one or more polyethene films were arranged on the surface of the topmost veneer layer in a manner known per se to form a coating on the surface of the wood panel.

Polyethene has the advantage that it comprises a narrow temperature range wherein it transforms from melt into solid form and vice versa, so that the making of the wood panel can be quickly processed. Other advantages are good adhesiveness and good moisture protection of the polyethene.

From the test it was discovered that a polyethene film is a suitable adhesive to be used for making both birch and spruce veneer wood panels. Further-


more, it was discovered that the same polyethene film is well suited for coating the wood panel.

Example 2

In this example, the thermoplastic material used for making birch veneer wood panels was a polyethene dispersion in the form of an aqueous solution.

The polyethene dispersion was spread between the veneers using a hand roller at about 125g/m². Then, the veneer lamination was pressed using the hot pressing process so that the water would evaporate and the polyethene would melt. As the water evaporated during the hot pressing, the polyethene formed a mechanical bond between the veneers. An aqueous dispersion of polyethene is quite easily processed, and the dispersion viscosity can be easily controlled by the amount of water or by foaming. In this embodiment, the melting point of the polyethene dispersion form was about 98°C.

From the test it was discovered that the polyethene dispersion was a suitable adhesive to be used for making birch veneer wood panels.

Example 3

In this example, the thermoplastic material used was an adhesive laminate waste comprising paper, polyethene and minor amounts of aluminium. If the adhesive laminate waste does not comprise enough polymer, then e.g. virgin polymer or a plastic starting material which is recycled or acquired from by-product flows can be added to the mixture.

The waste material was shredded, applied between the veneer layers in the shredded form and heated above the melting point of the polyethene using hot pressing technique. The veneer layers were pressed against each other so that they would adhere to each
other to form the wood panel. Cooling took place in conjunction with the pressing.

From the test it was discovered that the adhesive laminate waste material was a suitable adhesive to be used for making both birch and spruce veneer wood panels.

From the tests of examples 1 to 3 it was discovered that the wood panels, and particularly the adhesive included therein, are more sensitive to higher temperatures when a thermoplastic material is used as the adhesive in the making of the wood panels. However, the wood panels in accordance with the invention are waterproof at low temperatures, i.e. below the melting temperatures of the thermoplastic material.

The wood panels in accordance with examples 1 to 3 were bent by reheating. First, the wood panels were cut into pieces of 5cm in width and about 40 in length. The pieces were heated to the temperature of 120°C and pressed using a mould into the shape of a semi-circle with a radius of 30cm. The pressure time was about 5min, during which the temperature of the articles was cooled below the melting temperature of the polyethene, preferably to room temperature.

It was discovered that the wood panels in accordance with the invention were easily bendable by heat, and the bending was well maintained after cooling. Furthermore, it was discovered that the veneers would glide relative to each other during the bending step, so that there did not remain any tension in the bent piece that would cause tearing of the veneers in the cooled, bent piece. Moreover, it was discovered that if a mistake or such is made during the bending, the piece can be rebent by heating, in which case the thermoplastic material, i.e. polyethene, readheres, and the mistake will be corrected.
The method in accordance with the invention allows the making of different kinds of wood panels and bent products.

The wood panel in accordance with the invention is suitable in different embodiments to be used in various applications.

The embodiments of the invention are not limited to the examples referred to above; instead many variations are possible within the scope of the accompanying claims.
CLAIMS

1. A wood panel, formed of a number of veneer layers, characterized in that a thermoplastic material of adhesive quality is arranged between predetermined veneer layers, and the veneer layers are arranged against each other and joined together by means of the thermoplastic material, heat and pressure, to provide a wood panel.

2. The wood panel in accordance with claim 1, characterized in that the thermoplastic material is arranged on the surface of at least one veneer layer.

3. The wood panel in accordance with claim 1 or 2, characterized in that the thermoplastic material is arranged on the surface of the topmost veneer layer to provide a coating.

4. The wood panel in accordance with any one of claims 1 to 3, characterized in that the thermoplastic material comprises a thermoplastic agent of adhesive quality.

5. The wood panel in accordance with any one of claims 1 to 4, characterized in that the melting temperature of the thermoplastic agent is below 200°C, preferably below 180°C.

6. The wood panel in accordance with any one of claims 1 to 5, characterized in that the thermoplastic agent is a thermosetting plastic.

7. The wood panel in accordance with any one of claims 1 to 6, characterized in that the wood panel is arranged as a straight panel.

8. The wood panel in accordance with any one of claims 1 to 7, characterized in that the wood panel is arranged as a bent shape-product.

9. A method for making a wood panel, wherein the wood panel is formed of a number of veneer layers, characterized in that a thermoplastic material
of adhesive quality is arranged between predetermined veneer layers, the veneer layers are laid one upon the other, and the veneer layers are joined together by means of the thermoplastic material, heat and pressure.

10. The method in accordance with claim 9, characterized in that the thermoplastic material is arranged between the veneer layers in the solid form, melt form, or in the form of a dispersion or solution.

11. The method in accordance with claim 9 or 10, characterized in that the veneer layers are glued together by means of the thermoplastic material, and the thermoplastic material is heated and cooled and the veneer layers are pressed against each other in conjunction with the gluing to provide a wood panel.

12. The method in accordance with any one of claims 9 to 11, characterized in that the thermoplastic material is heated to the melting temperature of the thermoplastic agent included therein to glue the layers together, and cooled below the melting point of the thermoplastic agent.

13. The method in accordance with any one of claims 9 to 12, characterized in that the thermoplastic material is arranged on the surface of the topmost veneer layer to provide a coating.

14. The method in accordance with any one of claims 9 to 13, characterized in that a straight wood panel is formed.

15. The method in accordance with claim 14, characterized in that the formed wood panel or a piece cut off therefrom is arranged as a wood panel product bent into the desired shape.

16. The method in accordance with claim 14 or 15, characterized in that the formed wood
panel or the piece cut off therefrom is heated, shaped into the desired shape by form pressing, and cooled.

17. The method in accordance with any one of claims 14 to 16, characterized in that the wood panel is heated above the melting point of the thermoplastic agent and cooled back below the melting point.
A  CLASSIFICATION OF SUBJECT MATTER

See extra sheet

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)

IPC8: B27D, B27G, B29C, B32B, C09J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic database consulted during the international search (name of data base and, where practicable, search terms used)

EPO-INTERNAL, WPI

C.  DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>X</td>
<td>DE 3308843 A1 (WTZ HOLZVERARBEITENDE IND) 24 November 1983 (24.1.1983), p 7, paragraphs 3-4; p 8, paragraphs 7-8; examples 1 and 2; claims 4-6</td>
<td>1-10, 13-15</td>
</tr>
<tr>
<td>X</td>
<td>WO 8500318 A1 (VALTION TEKNILLINEN) 31 January 1985 (31.01.1985), figures 1-2; p 4, line 25 - p 5, line 33</td>
<td>1-2, 4, 6-7, 9, 11-12, 14</td>
</tr>
<tr>
<td>X</td>
<td>DE 102004036591 A1 (UNIV DRESDEN TECH) 09 February 2006 (09.02.2006), abstract; figure 1; paragraphs 9-15 and 21-22</td>
<td>1.9, 14-17</td>
</tr>
<tr>
<td>A</td>
<td>GB 2092063 A (YOSHIKAWA YOSHINOBU et al.) 11 August 1982 (11.08.1982)</td>
<td>1-9</td>
</tr>
<tr>
<td>A</td>
<td>US 5415943 A (GROGER HOWARD P et al.) 16 May 1995 (16.05.1995)</td>
<td>1-17</td>
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Further documents are listed in the continuation of Box C.  

See patent family annex

Date of the actual completion of the international search: 18 March 2008 (18.03.2008)

Date of mailing of the international search report: 30 April 2008 (30.04.2008)

Name and mailing address of the ISA/FI  
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<td></td>
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<td>DK 213783 A</td>
<td></td>
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<td></td>
<td>FI 830903 A</td>
<td>19/11/1983</td>
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<tr>
<td></td>
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<td>DD 206102 A 1</td>
<td>18/01/1984</td>
</tr>
<tr>
<td>WO 8500318 A 1</td>
<td>31/01/1985</td>
<td>FI 832401 A</td>
<td>31/12/1984</td>
</tr>
<tr>
<td>DE 102004036591 A 1</td>
<td>09/02/2006</td>
<td>None</td>
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<td></td>
<td>DE 3200116 A 1</td>
<td>04/11/1982</td>
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<td>JP 571 15343 A</td>
<td>17/07/1982</td>
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<td></td>
<td>CA 2 134883 A 1</td>
<td>15/09/1994</td>
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<tr>
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<td>AU 6275594 A</td>
<td>26/09/1994</td>
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# INTERNATIONAL SEARCH REPORT

### CLASSIFICATION OF SUBJECT MATTER

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