Title: FLOORING HAVING TRANSFER-PRINTED HDF AND PROCESS FOR MANUFACTURING THE SAME

Abstract: Disclosed herein is a low-priced flooring comprising a transfer-printed high-density fiberboard (HDF). According to the flooring, an aqueous primer layer is formed on a high-density fiberboard as a core layer and transfer printing is performed on the surface of the primer layer to form a printed layer so that the background fiber pattern of the high-density fiberboard is covered, the adhesion of the core layer to the printed layer is enhanced, and the natural beauty of wood is faithfully imparted to the surface of the flooring.
Description

FLOORING HAVING TRANSFER-PRINTED HDF AND PROCESS FOR MANUFACTURING THE SAME

Technical Field

The present invention relates to a flooring comprising a transfer-printed high-density fiberboard (HDF) and a process for manufacturing the flooring. More specifically, the present invention relates to a low-priced and highly durable flooring comprising a high-density fiberboard as a core layer and an aqueous primer layer formed on the core layer wherein transfer printing is performed on the surface of the primer layer to form a printed layer so that the background fiber pattern of the high-density fiberboard is covered, the adhesion of the core layer to the printed layer is enhanced, and the natural beauty of wood is faithfully imparted to the surface of the flooring.

Background Art

Conventional floorings for under-floor heating systems are manufactured by laminating a natural veneer on a water-resistant plywood and treating the natural veneer by surface coating. Such conventional floorings for under-floor heating systems have advantages in that the natural texture of wood is maximized and superior dimensional stability against heat and moisture is ensured due to the use of a water-resistant plywood. However, since a low-density veneer and a low-density water-resistant plywood (0.6-0.8 g/cm³) are used, conventional floorings for under-floor heating systems suffer from poor scratch resistance (0.5-3.0 N, as measured by scratching the surface of the floorings using a diamond chip) and poor impact resistance (10-20 cm, as measured by dropping a metal ball weighing 225g onto the surface of the floorings) although UV coating is performed on the surface of the floorings. Poor resistance to scratch and impact of conventional floorings generally causes many problems. For example, when a consumer drops a household appliance by mistake or transports a heavy object on the surface of conventional floorings, damage to the surface of the flooring may occur. In addition, a low thermal conductivity of conventional floorings leads to an energy loss.

On the other hand, conventional laminate floorings are manufactured by sequentially laminating a printed layer and a melamine-impregnated overlay sheet on a high-density fiberboard (HDF) layer as a base layer and laminating a balance layer under the base layer. Such conventional laminate floorings have a rigid surface, compared to water-resistant plywood floorings for under-floor heating systems. However, since the surface of conventional laminate floorings is composed of a ther-
mosetting melamine resin, it is sensitive to moisture and is highly likely to be brittle, thus giving a feeling of coldness to consumers. In addition, when a sharp or heavy object having a load exceeding a predetermined value drops onto conventional laminate floorings, the impact site is partly damaged, e.g., broken or indented. Furthermore, since the surface of conventional laminate floorings is artificially printed, the laminate floorings exhibit inferior natural texture of wood when compared to conventional water-resistant plywood floorings for under-floor heating systems.

**Disclosure of Invention**

**Technical Problem**

The present invention has been made in view of the above-mentioned problems of the conventional floorings, and it is one object of the present invention to provide a flooring comprising a high-density fiberboard as a core layer and an aqueous primer layer formed on the core layer wherein transfer printing is performed on the surface of the primer layer to form a printed layer so that the background fiber pattern of the high-density fiberboard is covered, the adhesion of the core layer to the printed layer is enhanced, the natural beauty of wood is faithfully imparted to the surface of the flooring, and the impact resistance of the flooring surface is greatly improved.

It is another object of the present invention to provide a flooring comprising a high-density fiberboard as a base layer, a waterproof backing layer formed under the base layer, and a surface coating layer in which the problem of deformation caused by a variation in humidity is perfectly solved by the formation of the waterproof backing layer, and the surface physical properties, such as scratch resistance and indentation resistance, of the flooring are greatly improved by the addition of a material selected from glass chops, ceramics, nano-sized inorganic materials, silica and mixtures thereof to the surface coating layer, thereby protecting the surface of the flooring against damage, e.g., indentation and breakage, caused by a heavy or sharp object.

It is yet another object of the present invention to provide a process for manufacturing a flooring with improved workability and productivity which comprises forming a primer layer, a transfer-printed layer, a surface coating layer, and a waterproof backing layer under respective optimum conditions.

**Technical Solution**

In accordance with one aspect of the present invention for achieving the above objects, there is provided a flooring comprising a high-density fiberboard layer, a primer layer and a printed layer laminated in this order from the bottom.

The flooring of the present invention is low-priced and highly moisture-resistant, compared to wood floorings and general laminate floorings. Further, since direct transfer printing is performed on the high-density fiberboard, the flooring of the
present invention exhibits greatly improved impact resistance and high thermal conductivity, which is thus advantageous in terms of energy saving, compared to water-resistant plywood floorings for under-floor heating systems.

The greatest advantage of the flooring according to the present invention is that the natural beauty of wood is faithfully imparted to the surface of the flooring by elaborate transfer printing, compared to the natural beauty of wood of laminate floorings, which are manufactured by sequentially laminating a printed layer and a melamine-impregnated overlay sheet on a high-density fiberboard as a base layer. Other advantages of the flooring according to the present invention are superior impact resistance, a feeling of warmness to consumers, and low price.

It is preferred that the primer layer is made of an aqueous resin taking into consideration the prevention of environmental pollution and improvement of productivity and workability. Examples of preferred aqueous resins that can be used in the present invention include acrylic urethane resins, epoxy resins, polyurethane resins, polyisocyanate resins, polyester resins, acrylate resins, ethylene-vinyl acetate copolymers, polyamide resins, melamine resins, synthetic rubbers, and polyvinyl alcohol resins. Aqueous acrylic urethane resins are particularly preferred.

The primer layer is preferably made using a two-solution type resin containing aqueous acrylic urethane (30 to 70 % by weight). 1 to 5 % by weight of an inorganic pigment is preferably added to the two-solution type resin to cover the background pattern of the high-density fiberboard.

The primer layer serves to enhance the adhesion between the high-density fiberboard layer and the transfer-printed layer, and is effective in enhancing the waterproof property of the finished product. Waterproof property is an important requirement for floorings.

The transfer-printed layer is made using a general-purpose polyethylene terephthalate (PET) transfer paper.

The waterproof backing layer is formed by coating the bottom surface of the high-density fiberboard layer with an ultraviolet (UV) curable surface-treating agent, a heat curable surface-treating agent, a synthetic resin, wax, a silicone-based water-repellent agent, a silicone-based waterproofing agent, or the like. The formation of the waterproof backing layer on the bottom surface of the high-density fiberboard layer can solve the problem of deformation caused by a variation in humidity.

The surface coating layer consists of a surface primer layer, an under coating layer, an intermediate coating layer and a top coating layer. The primer layer is made using an aqueous acrylic resin having a molecular weight of 100,000 to 200,000. An inorganic material selected from ceramics, glass chops, clays, silica and mixtures thereof is added to the under coating layer and the top coating layer to greatly improve
the surface physical properties, such as scratch resistance, of the flooring, thereby preventing the surface of the flooring from damage, e.g., indentation, breakage and scratch, caused by a heavy or sharp object.

[16] Finally, the flooring of the present invention is processed to have a tongue and groove (T & G) shape, a click system or a linking structure for a connector so that it can be joined to another flooring, which is the same one as the flooring of the present invention.

[17] In accordance with another aspect of the present invention, there is provided a process for manufacturing a flooring, the process comprising the steps of preparing a transfer printing paper and a high-density fiberboard layer, forming a waterproof backing layer under the high-density fiberboard layer, forming a primer layer on the high-density fiberboard layer, performing transfer printing on the surface of the primer layer under heat and pressure to form a transfer-printed layer, forming a surface coating layer consisting of a surface primer layer, an under coating layer, an intermediate coating layer and a top coating layer on the transfer-printed layer, and cutting and shaping the resulting structure.

[18] The step of forming a primer layer on the high-density fiberboard layer is preferably carried out by coating an aqueous resin to a predetermined thickness on the high-density fiberboard layer, and passing the coated structure through an oven at 80 to 160°C for 30 seconds to 5 minutes to dry and cure the coated structure.

[19] Taking into consideration the prevention of the deformation and improvement of the productivity of the final product, it is preferred to perform the transfer printing under 0.4 to 1.0 MPa at 80 to 120°C for 5 seconds to 2 minutes.

**Brief Description of the Drawings**

[20] The above and other objects, features and other advantages of the present invention will be more clearly understood from the following detailed description taken in conjunction with the accompanying drawings, in which:

[21] FIG. 1 is a cross-sectional view of a flooring according to an embodiment of the present invention;

[22] FIG. 2 is a process chart illustrating a process for manufacturing a flooring according to an embodiment of the present invention; and

[23] FIG. 3 is a top view of a finished product consisting of two floorings of the present invention, both of which have a tongue and groove (T & G) shape.

**Best Mode for Carrying Out the Invention**

[24] The present invention will now be described in detail with reference to the accompanying drawings.

[25] FIG. 1 is a cross-sectional view of a flooring according to an embodiment of the
present invention. As shown in FIG. 1, the flooring comprises a surface coating layer 10, a transfer-printed layer 20, a primer layer 30, a high-density fiberboard layer 40, and a waterproof backing layer 50 laminated in this order from the top. To enhance the water resistance of the flooring, the surface of the transfer-printed layer 20 is coated to form the surface coating layer 10, and the bottom surface of the high-density fiberboard layer is coated with a UV curable or heat curable surface-treating agent essentially composed of urethane acrylate or at least one material selected from synthetic resins, e.g., polyolefin and polyester, wax, silicone-based water-repellent agents and silicone-based waterproofing agents to form the waterproof backing layer 50. The waterproof backing layer serves to prevent penetration of moisture into the high-density fiberboard layer 40 to protect the flooring from decay and deformation.

The transfer-printed layer 20 is formed by using transfer printing techniques in order to make the most of natural beauty of wood. Depending on the needs of consumers, patterns of all species of trees, including oak, birch, cherry, maple and walnut, may be faithfully and freely realized. For the transfer printing, general-purpose PET transfer printing papers may be used.

The high-density fiberboard layer 40 is preferably formed of a high-density fiberboard (HDF) having a specific weight of 0.85 to 1.1 g/cm³. The high-density fiberboard is much harder, exhibits better water resistance and dimensional stability, and has higher mechanical strength than a medium-density fiberboard (MDF) or a particle board (PB). Accordingly, when the high-density fiberboard is used to form the base layer, the dimensional stability, impact strength and moisture resistance of the flooring can be greatly improved.

The high-density fiberboard is low priced and exhibits good wear resistance and impact resistance, compared to a water-resistant plywood. In addition, the high-density fiberboard is free of defects, such as knots, and exhibits uniform physical properties because fibers are orderly arranged in every direction. The HDF can be easily processed so as to have a very smooth and soft surface. Accordingly, the surface of the flooring using the HDF gives a feeling of smoothness and softness. The flooring of the present invention is processed to have a mechanical fixing system, such as a click construction structure or a linking structure for a connector so that it can be integrally joined to another flooring, which is the same one as the flooring of the present invention, in a vertical or horizontal direction. In addition, the flooring of the present invention elastically responds to expansion and shrinkage, thus avoiding loosening or damage to bonding of the floorings.

The primer layer 30 serves to cover the background fiber pattern of the high-density fiberboard and enhance the adhesion between the high-density fiberboard layer 40 and the transfer-printed layer 20. The primer layer is preferably made of an aqueous resin.
Examples of preferred aqueous resins that can be used in the present invention include acrylic urethane resins, epoxy resins, polyurethane resins, polyisocyanate resins, polyester resins, acrylate resins, ethylene-vinyl acetate copolymers, polyamide resins, heat-curable melamine resins, synthetic rubbers, and polyvinyl alcohol resins. Aqueous acrylic urethane resins are particularly preferred.

As regulations restricting the use of volatile organic compounds (VOCs) are increasingly stringent and sick house syndrome is highlighted as a serious problem, general organic solvent type resins that are widely used in the art cannot be used to manufacture the flooring of the present invention. Instead, an aqueous resin is used in the present invention to reduce the amount of formaldehyde released to almost zero and prevent the occurrence of volatile organic solvents.

The formation of the surface coating layer 10 is achieved by UV coating the surface of the transfer-printed layer 20. The surface coating layer generally consists of a surface primer layer, an under coating layer, an intermediate coating layer and a top coating layer, which are sequentially formed on the transfer-printed layer 20.

To enhance the impact resistance and indentation resistance of the flooring surface, the surface primer layer is formed by UV curing of monomers and oligomers having a relatively low molecular weight. This UV curing facilitates the coating of the monomers and oligomers and is preferably carried out for 10 seconds to 4 minutes.

An inorganic material, such as a glass chop, may be added to the under coating layer to enhance the surface physical properties of the flooring. At this time, the inorganic material is preferably added in an amount of 0.1% to 10% by weight.

A nano-sized inorganic material or silica may be added to the top coating layer to enhance the scratch resistance and wear resistance of the flooring surface. At this time, the nano-sized inorganic material or silica is preferably added in an amount of 0.1% to 10% by weight.

The waterproof backing layer 50 is laminated under the high-density fiberboard layer 40 to enhance the water resistance of the flooring. The waterproof backing layer 50 is formed by coating the bottom surface of the high-density fiberboard layer 40 with a UV curable or heat curable surface treating agent essentially composed of urethane acrylate or at least one material selected from synthetic resins, e.g., polyolefin and polyester, wax, silicone-based water-repellent agents and silicone-based waterproofing agents. The waterproof backing layer functions to prevent penetration of moisture into the high-density fiberboard layer 40 to protect the flooring from decay and deformation.

Taking into consideration the ease of assembly, the flooring of the present invention is preferably processed into a general tongue and groove (T & G) shape, but is not limited to this structure. For example, the flooring of the present invention may be
processed to have a mechanical fixing system, such as a click construction structure or a linking structure for a connector so that it can be integrally joined to another flooring, which is the same one as the flooring of the present invention, in a vertical or horizontal direction.

FIG. 2 is a process chart illustrating a process for manufacturing a flooring according to an embodiment of the present invention. As shown in FIG. 2, the process comprises the steps of forming a waterproof backing layer under a high-density fiberboard layer 40 (a first step), forming a primer layer 30 on the high-density fiberboard layer (a second step), forming a transfer-printed layer 20 on the primer layer (a third step), performing surface coating of the transfer-printed layer 20 (a fourth step), and cutting and shaping the resulting structure (a fifth step).

In the second step, the primer layer 30 is preferably dried at 80 to 160°C. An excessively high drying temperature causes severe deformation of the high-density fiberboard. Meanwhile, too low a drying temperature may cause poor adhesion between the transfer-printed layer 20 and the high-density fiberboard layer 40. Even when the two layers are adhered to each other, bad surface leveling may be caused at too low a drying temperature.

In the third step, transfer printing is preferably performed under a pressure of 0.4 to 1.0 MPa. The transfer-printed layer may be ruptured at too high a printing pressure. Meanwhile, poor printing may be caused at too low a printing pressure. The transfer printing is preferably performed for 5 seconds to 2 minutes. Too short a printing time may cause occurrence of poor printing due to incomplete transfer of a printing ink. Meanwhile, too long a printing time may result in rupture of the transfer-printed layer.

Unlike the process shown in FIG. 2, according to further embodiments of the present invention, a flooring may be manufactured by sequentially forming a primer layer 30, a transfer-printed layer 20 and a surface coating layer 10 on a high-density fiberboard layer 40 and forming a waterproof backing layer 50 under the high-density fiberboard layer 40; or by forming a primer layer 30 on a high-density fiberboard layer 40, forming a waterproof baking layer 50 under the high-density fiberboard layer 40, and sequentially forming a transfer-printed layer 20 and a surface coating layer on the primer layer 30.

In the fourth step, a surface coating layer 10 is formed on the transfer-printed layer 20. The surface coating is performed by UV curing, which is a technique employed to manufacture general floorings. Specifically, a surface primer layer, an under coating layer, an intermediate coating layer and a top coating layer are sequentially formed on the transfer-printed layer 20, followed by UV curing.

The surface coating layer 10 is made of a UV curable or heat curable synthetic resin essentially composed of urethane acrylate. To achieve desired surface physical
properties, such as superior resistance to indentation and impact, the surface coating layer 10 is made of at least one resin selected from the group consisting of epoxy resins, polyamide resins, urea resins and acrylate resins. Particularly preferred is an epoxy resin.

To enhance the impact resistance and indentation resistance of the flooring surface, the surface primer layer is formed by curing oil-phase or aqueous monomers and oligomers having a relatively low molecular weight at 80 to 150°C. This UV curing facilitates coating of the monomer and oligomer layer on the transfer-printed layer and is preferably carried out for 10 seconds to 4 minutes.

An inorganic material selected from ceramics, glass chops and mixtures thereof may be added to the under coating layer. The inorganic material is preferably added in an amount of 0.1% to 10% by weight. At least one inorganic or nano-sized inorganic material selected from clays, ceramics and silica may be added to the top coating layer to improve the scratch resistance of the flooring surface. It is preferred to sufficiently disperse 0.1 to 10 parts by weight of the inorganic material in 100 parts by weight of a urethane acrylate resin and add the dispersion to the top coating layer so as not to affect the transparency of the top coating layer.

FIG. 3 is a top view of a finished product consisting of two floorings of the present invention, both of which have a tongue and groove (T & G) shape. As shown in FIG. 3, four sides of the finished product in both length and width directions are processed into two tongue sites 80 and two groove sites 90. Alternatively, the flooring of the present invention may be processed to have a mechanical fixing system, such as a click system or a system for a connector, so that it can be integrally joined to another flooring, which is the same one as the flooring of the present invention, in a vertical or horizontal direction.

Mode for the Invention

Hereinafter, preferred embodiments of the present invention will be explained. However, these embodiments are given for the purpose of illustration and are not intended to limit the present invention.

EXAMPLES

Example 1

A UV curable coating layer was formed under a high-density fiberboard layer 40 as a base layer to form a waterproof backing layer 50. A primer layer 30 was formed on the high-density fiberboard layer 40 and a transfer-printed layer 20 was formed thereon under heat and pressure. A surface coating layer 10 was formed on the transfer-printed layer 20, followed by cutting and processing into a tongue 80 and groove 90 shapes to complete manufacture of the flooring shown in FIG. 1.
Specifically, the primer layer 30 was formed using a two-solution type resin containing 50% by weight of aqueous acrylic urethane, and dried by passing the coated structure through an oven at 120°C for 2 minutes. The transfer-printed layer was made by using a general-purpose PET paper under heat (100°C) and pressure (0.7 MPa) for one minute. The base layer 40 was made using an HDF. The HDF used herein had a density of 900 kg/m³ or more, water content of 4.0 to 7.0% and a thickness of 7.5 to 8.0 mm.

A surface primer layer, an under coating layer and an intermediate coating layer were sequentially formed on the transfer-printed layer 20. 5% by weight of a ceramic was added to the under coating layer. The resulting structure was cut to a width of 85 to 95 mm and a length of 850 to 950 mm using a tenoner, and the sides were processed to have a T & G shape. A top coating layer containing 5% by weight of a nano-sized inorganic material was formed on the intermediate coating layer, completing manufacture of a final flooring.

Example 2
A flooring was manufactured in the same manner as in Example 1, except that the primer layer 30 was made by using a one-solution type resin containing 62% by weight of aqueous acrylate and drying was carried out in an oven at 120°C for one minute.

Comparative Example 1
A natural veneer was laminated on a water-resistant plywood as a base and surface-coated by UV curing to manufacture a plywood flooring for an under-floor heating system.

Comparative Example 2
A melamine resin was coated on a high-density fiberboard (HDF) as a base to manufacture a laminate flooring.

Test Example 1
The physical properties of the floorings manufactured in Examples 1 and 2 were compared with those of the floorings manufactured in Comparative Examples 1 and 2. The results are shown in Table 1.

<table>
<thead>
<tr>
<th>Example No.</th>
<th>Indentation resistance</th>
<th>Breakage resistance</th>
<th>Dimensional stability (%)</th>
<th>Scratch resistance</th>
<th>Thickness expansion rate after water absorption</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>L</td>
<td>W</td>
<td>L</td>
<td>W</td>
<td></td>
</tr>
<tr>
<td>Example 1</td>
<td>20 cm</td>
<td>50 cm</td>
<td>-0.17</td>
<td>-0.20</td>
<td>0.07</td>
</tr>
<tr>
<td>Example 2</td>
<td>20 cm</td>
<td>50 cm</td>
<td>-0.20</td>
<td>-0.20</td>
<td>0.08</td>
</tr>
<tr>
<td>Comparative Example 1</td>
<td>10 cm</td>
<td>20 cm</td>
<td>-0.15</td>
<td>-0.18</td>
<td>0.05</td>
</tr>
<tr>
<td>Comparative Example 2</td>
<td>10 cm</td>
<td>35 cm</td>
<td>-0.26</td>
<td>-0.32</td>
<td>0.10</td>
</tr>
</tbody>
</table>
The indentation resistance of the floorings was evaluated by dropping a flat-head screwdriver weighing HOg onto the surfaces (inclined at an angle of 45 degrees relative to the horizontal plane) of the floorings and measuring a height at which surface indentation was observed. As is apparent from the data shown in Table 1, the surfaces of the laminate flooring (Comparative Example 2) and the plywood flooring for an under-floor heating system (Comparative Example 1) were indented when the flat-head screwdriver was dropped from a height of 10 cm, while the surfaces of the floorings (Examples 1 and 2) were indented when the flat-head screwdriver was dropped from a height of 20 cm.

The breakage resistance of the floorings was evaluated by dropping an iron ball having a diameter of 3 cm and a weight of 228g onto the surfaces of the floorings and measuring a height at which surface breakage was observed. As can be seen from the data shown in Table 1, the surfaces of the laminate flooring (Comparative Example 2) and the plywood flooring for an under-floor heating system (Comparative Example 1) were broken when the iron ball was dropped from heights of 35 cm and 20 cm, respectively, while the surfaces of the floorings according to the present invention (Examples 1 and 2) were broken when the iron ball was dropped from a height of 50 cm.

The dimensional stability of the floorings was evaluated by allowing the floorings to stand in an oven at 80°C and a water bath at room temperature for 24 hours and measuring dimensional variations in length (L) and width (W). According to the test results of Table 1, the dimensional stability of the floorings according to the present invention was slightly poor when compared to that of the plywood flooring for an under-floor heating system, but was excellent when compared to that of the laminate flooring.

The scratch resistance of the floorings was evaluated by measuring the degree of surface scratching under a load (N) using a Clemens-type scratch hardness tester in accordance with the procedure described in Paragraph 3.15 of the standard method KS M3332. From the test results of Table 1, it could be confirmed that the scratch resistance (5.0 N) of the floorings according to the present invention was superior to that (3.0 N) of the plywood flooring for an under-floor heating system and that (4.0 N) of the laminate flooring.

The thickness expansion rate of the floorings after water absorption was evaluated by dipping the floorings in water at room temperature for 24 hours (U type, Paragraph 6.9 of KS F32009) and water at 70°C for 2 hours (M type), and measuring the variation in the thickness of the floorings. As is evident from the test results of Table 1, the thickness expansion rates (2.5%) of the floorings according to the present invention were comparable to the absorption, but the thickness expansion rates (30%
and 35%) of the floorings (Examples 1 and 2) according to the present invention were much lower than the thickness expansion rate (50%) of the laminate flooring after M type water absorption.

The warp stability of the floorings (Examples 1 and 2) was compared with that of the floorings (Comparative Examples 1 and 2). The results are shown in Table 2.

Table 2

<table>
<thead>
<tr>
<th>Example No.</th>
<th>Warp stability</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Width (W, mm)</td>
</tr>
<tr>
<td>Example 1</td>
<td>0.03</td>
</tr>
<tr>
<td>Example 2</td>
<td>0.03</td>
</tr>
<tr>
<td>Comparative Example 1</td>
<td>0.15</td>
</tr>
<tr>
<td>Comparative Example 2</td>
<td>0.17</td>
</tr>
</tbody>
</table>

The warp stability of the floorings was evaluated by allowing the samples to stand in an oven at 80 ± 2°C for 24 hours and measuring the number of curls and domes. As a result, the warp stability in the width direction of the floorings according to the present invention was excellent when compared to the laminate flooring and the plywood flooring for an under-floor heating system. In addition, the warp stability (1.21 mm and 1.30 mm) in the lengthwise direction of the floorings (Examples 1 and 2) according to the present invention was slightly poor when compared to that (0.96 mm) of the conventional laminate flooring (Comparative Example 2), but was much better than that (5.77 mm) of the plywood flooring (Comparative Example 1) for an under-floor heating system.

From these experimental results, it could be presumed that the floorings of the present invention showed superior surface physical properties, e.g., superior resistance to indentation and breakage caused by a heavy or sharp object, as compared to the plywood flooring for an under-floor heating system and the laminate flooring, and that the balance of the floorings of the present invention was maintained due to the symmetrically designed structure, thus making the floorings stable.

Industrial Applicability

As apparent from the above description, according to the flooring of the present invention, an aqueous resin (e.g., aqueous acrylic urethane) is coated on a high-density fiberboard as a core layer to form a primer layer and transfer printing is performed on the surface of the primer layer to form a printed layer so that the background fiber pattern of the high-density fiberboard is covered and the adhesion of the core layer to the printed layer is enhanced.

In addition, according to the flooring of the present invention, direct transfer printing is performed on the surface of the high-density fiberboard so that the impact resistance of the flooring is greatly improved. The addition of an organic material selected from glass chops, ceramics, clays, silica and mixtures thereof to a surface
coating layer formed on the printed layer leads to considerable improvement of the surface physical properties, such as indentation resistance and scratch resistance, of the flooring. A waterproof layer formed under the high-density fiberboard layer serves to solve the problem of deformation caused by a variation in humidity and provides excellent thermal conductivity to the flooring when compared to wood. Furthermore, according to the flooring of the present invention, the transfer-printed layer faithfully realizes the natural beauty of wood, and particularly, direct transfer printing on the high-density fiberboard layer is ensured, thus minimizing an increase in manufacturing cost, which arises from the use of expensive materials for surface layers of conventional floorings.
Claims

[I] A flooring comprising a high-density fiberboard layer, a primer layer and a printed layer laminated in this order from the bottom.

[2] The flooring according to claim 1, wherein the primer layer is made of an aqueous resin.

[3] The flooring according to claim 2, wherein the aqueous resin is selected from acrylic urethane resins, epoxy resins, polyurethane resins, polyisocyanate resins, polyester resins, acrylate resins, ethylene-vinyl acetate copolymers, polyamide resins, melamine resins, synthetic rubbers, polyvinyl alcohol resins, and mixtures thereof.

[4] The flooring according to claim 3, wherein the primer layer is made of a two-solution type resin containing aqueous acrylic urethane.

[5] The flooring according to claim 1, wherein the primer layer contains 1 to 5 % by weight of a pigment.

[6] The flooring according to claim 1, wherein the printed layer is a transfer-printed layer formed using a general-purpose polyethylene terephthalate (PET) transfer paper.

[7] The flooring according to claim 1, comprising a waterproof backing layer, a high-density fiberboard layer, a primer layer, a transfer-printed layer and a surface coating layer laminated in this order from the bottom.

[8] The flooring according to claim 7, wherein the waterproof backing layer is formed by coating the bottom surface of the high-density fiberboard layer with at least one material selected from ultraviolet (UV) curable surface-treating agents, heat curable surface-treating agents, synthetic resins, wax, silicone-based water-repellent agents, and silicone-based waterproofing agents.

[9] The flooring according to claim 7, wherein the surface coating layer includes a surface primer layer, an under coating layer, an intermediate coating layer and a top coating layer sequentially formed on the transfer-printed layer.

[10] The flooring according to claim 9, wherein the under coating layer and the top coating layer contain an inorganic material.

[II] The flooring according to claim 10, wherein the inorganic material is selected from ceramics, glass chops, clay, silica, and mixtures thereof.

[12] The flooring according to claim 1, wherein the flooring has a tongue and groove (T & G) shape, a click system, or a linking structure by a connector.

[13] A process for manufacturing a flooring, comprising the steps of: forming a waterproof backing layer under a high-density fiberboard layer; forming a primer layer on the high-density fiberboard layer;
performing transfer printing on the surface of the primer layer to form a transfer-printed layer;
forming a surface coating layer on the transfer-printed layer; and
cutting and shaping the resulting structure.

[14] The process according to claim 13, wherein the primer layer is formed by coating
an aqueous resin on the high-density fiberboard layer, and drying the coated
structure in an oven at 80 to 160°C for 30 seconds to 5 minutes.

[15] The process according to claim 13, wherein the transfer printing is performed
under 0.4 to 1.0 MPa at 80 to 120°C for 5 seconds to 2 minutes.
First step: Formation of waterproof backing layer under high-density fiberboard

Second step: Formation of primer layer on the high-density fiberboard

Third step: Formation of transfer-printed layer on the primer layer

Fourth step: Formation of surface coating layer on the transfer-printed layer

Fifth step: Cutting and shaping
## A. CLASSIFICATION OF SUBJECT MATTER

**B32B 27/12(2006.01)**

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)

- **B32B 27/08**

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

Korean Patents and applications for inventions since 1975.

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

**PAJ**

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>KR 2001-87432 A (LG Cl Ltd) Sep 15 2001 See The Whole Documents</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>US 4362775 A (Toray Industries, Inc Toyo Seikan Kaisha, Ltd ) Dec 7 1982 See The Whole Documents</td>
<td>1</td>
</tr>
</tbody>
</table>

Further documents are listed in the continuation of Box C

See patent family annex

- **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.
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- **&** - document member of the same patent family.

**Date of the actual completion of the international search**

07 FEBRUARY 2007 (07 02 2007)

**Date of mailing of the international search report**

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