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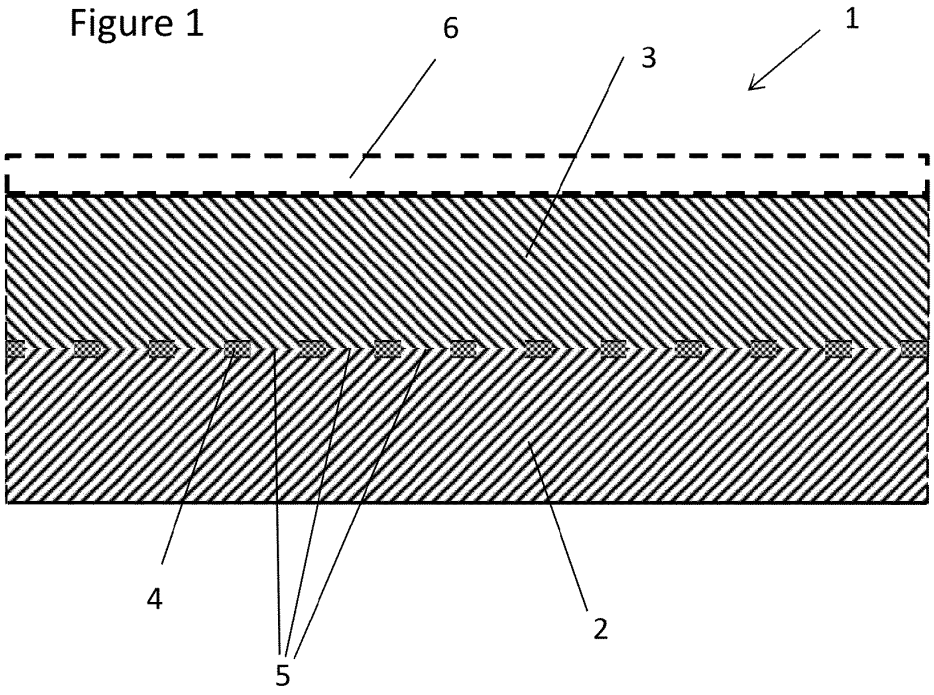
(54) **LINOLEUM FLOOR COVERING**

(57) The present invention provides a linoleum floor covering comprising:
a first layer of cured linoleum composition;
a second layer of cured linoleum composition, and
a reinforcement layer having multiple through openings arranged between the first layer and the second layer,
wherein a combined surface area of the through openings is at least 50% of the total surface are of the reinforcement layer,
wherein the first layer and second layer are adhered to each other through the through openings, and
wherein the reinforcement layer is made of knitted material.

Figure 1



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Description

[0001] The present invention relates to floor coverings, and more particularly to linoleum floor-coverings.

[0002] Linoleum is a material that has been around for many years and found its use in various applications. Typically and originally linoleum is used as a floor covering. The production method for linoleum is well known and often described. Challenges involved in the processing of linoleum have also frequently been addressed.

[0003] Conventionally linoleum is made from linseed oil, rosin, wood flour, ground cork, limestone and pigments. The pre-processed linoleum components are calendered on and bonded to a suitable backing material, most commonly a jute fabric. The sheet like material is then heat cured for a period of time after which it is coated and cut to size in order to be rolled up and hence obtain rolls of floor covering.

[0004] In common with many floor-covering materials based on this type of construction, where a wear resistant surface is applied to a carrier, difficulties of dimensional stability and curling of the material are encountered. This is due to differential stresses being introduced to the component layers during manufacture, or on exposure to differing ambient conditions in the use of floor-covering. As linoleum comprises to a significant extent of wood flour, which is sensitive to moist and will either shrink or expand in volume due to changes in atmospheric humidity, problems of dimensional stability can be particularly troublesome.

[0005] While the above may not present a problem where traditional linoleum sheet is acclimatised and cut to size just before installation, then glued down using suitable adhesives, which restrain the material from further movement. Linoleum tiles, however, when pre-cut from traditional sheet material, can undergo a significant change in dimension between production and installation.

[0006] Traditional linoleum is therefore not entirely suitable as the basis for individual linoleum tiles. This particular problem was recognized and addressed by EP 0074681, which specifies a carrier or substrate in the form of an open mesh woven fabric which endows the material with acceptable dimensional stability. The construction specified in EP 0074681 is however still essentially heterogenous or "unbalanced" so that differential stresses in the layers can still lead to unacceptable curling. Complex and rigid control measures are therefore needed in the manufacturing process in order to ensure the production of an satisfying product.

[0007] WO 97/19219 discloses a linoleum floor-covering comprising a carrier and a layer of cured linoleum composition adherently attached at one side of the said carrier, and a second layer of cured linoleum composition is adherently attached at the other side of said carrier. The carrier is a woven material having an adhesive coating for promoting adhesion of the linoleum layers to the carrier.

[0008] WO 97/44518 discloses a flooring tile comprising an upper linoleum layer and a lower linoleum layer and a carrier between them. The floor tile is constructed to retain its flat shape by arranging the upper linoleum layer and linoleum lower layer at opposite sides of the carrier. The linoleum upper and lower layers are adhered to the carrier.

[0009] A drawback of the floor covering constructions of WO 97/19219 and WO 97/44518 is that the distance between the carrier and the surface of the wear layer becomes relatively small, resulting in a high chance of emergence of the carrier structure to the surface. This issue, referred to as telegraphing, is caused by the thickness of the weft and warp threads plus corresponding crossing points. To avoid the occurrence of telegraphing, the linoleum wear layer should be made of sufficient thickness to counteract the variation in the carrier. In order to retain the stabilized construction, the subfloor facing linoleum layer also needs an increased thickness, with high material consumption and production costs as a result.

[0010] A further drawback of the floor covering constructions of WO 97/19219 and WO 97/44518 is that due to the relatively thick and heavy final product, the flexibility of the material is negatively affected.

[0011] It is an object of the present invention to avoid or minimize one or more of the above drawbacks.

[0012] The present invention provides a linoleum floor covering as claimed in claim 1.

[0013] The advantage of the floor covering according to the invention is that the first and second linoleum layers at opposite sides of the reinforcement layer are bonded to each other through the through openings. The reinforcement layer is enclosed between the first layer and the second layer, but not used for bonding the first and second linoleum layers with respect to each other. The material replacing the conventional carrier is due to its characteristics and functionality, which deviate substantially from the conventional carrier, referred to as reinforcement layer.

[0014] It has been found that by using a reinforcement layer having through openings which account for a sufficiently large area to allow the first layer and second layer to effectively adhere to each other through the openings, an additional bonding/adhesive agent to adhere the first layer and second layer to the carrier and/or each other becomes redundant. After heat curing, the two linoleum layers are chemically bond as a consequence of the natural oxidative polymerization reaction occurring in linoleum.

[0015] This advantage can only be obtained when the reinforcement layer is of small presence. The reinforcement layer should accordingly be relatively thin, for example less than 0,50 mm, for instance 0,25-0,35 mm, and preferably also be of relatively low weight, for example less than 100 g/m^2, for instance 50 to 100 g/m^2. By way of comparison, a typical jute carrier has a thickness of 0,55-0,65 mm and a weight in the order of 230 to 250

g/m^2.

[0016] The combined surface area of the through openings is at least 50% of the total surface area of the reinforcement layer. It has been found that a patency of the material of at least 50% provides sufficient surface area to bond the first layer and the second layer with each other without the need of additional adhesive or bonding agents. This bond is sufficiently strong to avoid delamination of the first and second layers during normal use. For reference purposes, a conventional open backing material has an openness factor ranging from 10 to 40%.

[0017] Each individual through opening may have a surface area of 1 mm^2 to 10 mm^2. This surface area provides sufficient space for proper bonding between the first layer and the second layer.

[0018] The reinforcement layer is made of a knitted material having thread filaments that follow a meandering path forming loops. These meandering loops interconnect the thread filaments into a pattern of threads. In the knitted material, the crossing points of the threads are interconnected to each other by the thread filaments from which the reinforcement layer is knitted. This interconnection of the crossing points by the thread filaments results in a construction with high dimensional stability.

[0019] In an embodiment, the reinforcement layer made of a warp knitted mesh. The warp knitted mesh may be made by a warp knitting technique that provides a knitted fabric comprising several yarns in which the wales and courses run roughly parallel to itself. The wale being a column of loops corresponding to the first direction of the reinforcement layer. Each course is a meandering row of loops, moving both with the direction of the wale and in a second direction of the reinforcement layer, interlocking to the wale loops at each crossing and connecting the individual columns of wale loops to each other. The first direction and the second direction are preferably perpendicular to each other. The first direction is for example a length direction of the reinforcement layer and the second direction a width direction of the reinforcement layer perpendicular to the length direction.

[0020] This knitting technique ensures the acquisition of a construction with high dimensional stability and makes it possible to manufacture a reinforcement layer having a relatively large openness factor and having a relatively small thickness and weight, while at the same time having sufficient dimensional stability for use in a modular linoleum floor covering.

[0021] The yarns in the knitted reinforcement layer may for example be made of hydrophobic fibres such as polyester, glass, carbon, metal and similar materials. The yarns in the knitted reinforcement layer may also be made from natural fibres, such as cotton, hemp, flax and bamboo, preferably treated to reduce the hydrophilicity. In an embodiment, it is possible to combine multiple types of fibres to obtain a hybrid knitted reinforcement layer with desired properties.

[0022] The reinforcement layer may undergo a pre-treatment process for fixating, dressing, finishing, coating or impregnating. These processes can be used to join the thread filaments of the knitted material together and to fill remaining cavities between the fibres, improving dimensional stability.

[0023] The fixator that can be used to fixate the fibres of the reinforcement layer is for example made from a natural source such as potato starch but also from synthetic origin such as polyvinyl alcohol (PVA).

[0024] For increasing the mechanical strength of the reinforcement layer a thermal fusing step may be included wherein the thread filaments are fused with each other.

[0025] The linoleum compositions used in the first and second layer of the linoleum floor covering may be substantially similar to those used in conventional linoleum floor coverings. Thus in general each of the first and second layers comprises a homogeneous mixture of linoleum cement, cork and/or wood flour, inorganic fillers and, if desired, pigments. Recycled content comprising the above-mentioned linoleum composition may also be used as a filler. The linoleum cement is the binder in linoleum, consisting of a mixture of linseed oil and/or other vegetable drying oils, rosin and drying oil catalysts, which is converted to a semi-elastic mass by an oxidative curing process.

[0026] The first and second layers may be substantially similar, and desirably are of a generally comparable thickness and composition so as to provide a balanced resistance to curl or other dimensional distortion at both sides of the product. Nevertheless it may be desirable to have differences, for example, for reasons of economy the bottom layer may have a greater filler and/or recycled content whilst the composition of the top layer may be optimized for higher wear resistance and/or design perspective by generally known means such as modifying the composition. Thickness and composition of the layers both contribute to the forces exerted by each layer with respect to the other. When differences between the layers are present, they are desirably implemented in a combination of parameters so that the stresses are balanced in the final cured material. With the ability to tune the amount of stress at each side of the floor covering, a counter stress can be applied intentionally in anticipation of print and/or coating layers which are added to the material after the curing process in order to compensate for the tension of these layer(s) in advance.

[0027] Where it is desired to use substantially different compositions in the first and second layers e.g. to provide distinct top (wear) and bottom layers, then the "balancing" of these, most conveniently by means of adjustment of their relative thickness in the final floor-covering, may be carried out by research - as with other laminated multilayer sheet materials.

[0028] The combined surface area of the through openings is at least 50% of the total surface area of the reinforcement layer, for example about 60%. The combined surface area of the through openings is for example

in the range of 50% to 70%, for example 55% to 65 % of the total surface area of the reinforcement layer.

[0029] In an embodiment, the through openings are distributed in a regular pattern over the reinforcement layer. In order to obtain substantially the same adherence between the first layer and the second layer over the whole surface area of the linoleum floor-covering, it is advantageous to use the same pattern of through openings.

[0030] In an embodiment, the reinforcement layer comprises knitted threads in a first direction and in a second direction perpendicular to the first direction, i.e. the threads run at right angles with respect to each other forming rectangular through openings therein between.

[0031] In an embodiment, the reinforcement layer has a constant thickness. Due to the use of knitted material, for example warp knitted material, for the reinforcement layer can be made with a constant thickness. This means that the lower and upper surface of the reinforcement layer are substantially flat. It will be clear that the reinforcement layer will not have the same thickness at the locations of the through openings. By providing such reinforcement layer with constant thickness, it is avoided that local thicker points cause the occurrence of so-called telegraphing, i.e visible areas on the surface of the floor. Since telegraphing is practically non-existing when using this reinforcement layer, the thickness of the first and second layer of cured linoleum composition may also be thinner, which results in a lighter and more flexible linoleum floor covering.

[0032] The constant thickness of the reinforcement layer also allows to manufacture a linoleum floor covering with flat top and bottom surfaces, even when the first and second linoleum layers are made relatively thin. The contact area between the bottom of the floor covering and the subfloor, underlay or supporting material is therefore increased and approaches 100%. As a result, less glue, different kinds of glue or even no glue is needed to install the linoleum floor covering. Also, this advantage may be used for adding properties to the cured linoleum by way of lamination, such as an acoustic layer.

[0033] In an embodiment, a maximum thickness of the reinforcement layer is in the range of 0.05 to 0.5 mm, for example in the range of 0.2 to 0.4 mm. Since the reinforcement layer is no longer used to bond the first layer and the second layer of linoleum, the reinforcement layer can be made of a low amount of material and having a relatively small thickness compared with conventional carriers used for linoleum. Moreover, since the reinforcement layer has a relatively small thickness and arranged in the middle of the linoleum floor covering, the flexibility, i.e. the bendability, of linoleum floor covering is very limited affected by the reinforcement layer of the linoleum floor covering compared to conventional floor covering constructions.

[0034] In an embodiment, the mass percentage of the reinforcement layer is maximally 5% of the total weight of the linoleum floor covering, for example maximally 3% of the total weight of the linoleum floor covering. As explained above, the knitted reinforcement layer can be made with small thickness and still having sufficient dimensional stability. The mass percentage of the reinforcement layer 4 may for example be maximally 4% for a linoleum floor covering with a thickness < 2.5 mm and maximally 3% for a linoleum floor covering with a thickness of ≥ 2.5 mm of the total weight of the linoleum floor covering 1.

[0035] In an embodiment, a hydrophobicity of the reinforcement layer is the same or larger than a hydrophobicity of the first and second layer. This improves the dimensional stability of the linoleum floor covering.

[0036] In an embodiment, the reinforcement layer has a first tensile strength in a first direction and a second tensile strength in a second direction perpendicular to the first direction, wherein the first tensile strength is larger than the second tensile strength. The first direction with high tensile strength can be used as production direction, i.e. the direction in which the sheet of materials is moved through the manufacturing equipment.

[0037] In an embodiment, the floor covering is a tile or panel. The construction of the linoleum floor covering of the invention has a high dimensional stability. Due to the first layer and second layer being arranged at opposite sides of the reinforcement layer, the linoleum floor covering is susceptible to curl. This makes the linoleum floor covering very suitable to be used for linoleum tiles and panels.

[0038] In an embodiment, the reinforcement layer is made of a non-porous material. In known embodiments of linoleum floor coverings, the carrier is made of porous material to increase the adhering of the linoleum material of the first layer and the second layer to the carrier. Since the reinforcement layer is not used to adhere the first layer and/or second layer, there is no need to provide a porous material. This increases the possibilities to use a suitable knitting material for knitting the reinforcement layer. The use of non-porous material has the additional advantage that the reinforcement effect of the reinforcement layer is not negatively affected by the presence of cavities between fibres which are present in the porous material.

[0039] In an embodiment, the reinforcement layer is free of adhesive material to adhere the first layer and/or the second layer to the reinforcement layer.

[0040] In an embodiment, the first layer and/or the second layer is provided with a further layer, such as a coating layer, a printed layer, an acoustic layer and/or a self-adhesive layer. Since the outer surfaces, e.g. top and bottom surfaces can be made with high flatness, further layers can be easily and/or reliably be attached to the first layer and/or second layer.

[0041] For example, on the top side of the floor covering a coating layer and/or a printed layer may be provided without the need of additional pre-treatment steps such as sanding or grinding.

[0042] Another advantage is that relatively less thick

primer layers are needed to obtain a flat top surface for printing on the top side of the floor covering.

[0043] Correspondingly, an acoustic layer and/or a self-adhesive layer may be arranged on the lower surface of the floor covering without the need of additional treatment steps such as sanding or grinding. Another advantage is that relatively less adhesive is needed to obtain a flat bottom surface. The acoustic layer and/or self-adhesive layer may for example be laminated on the bottom surface of the floor covering.

[0044] The invention further provides a method for manufacturing of a linoleum floor covering as claimed in claim 15. The reinforcement layer may have any of the additional features described in claims 2-14.

[0045] According to this method, the linoleum floor covering is manufactured by applying first linoleum layer at a first side of a reinforcement layer and applying a second linoleum layer at a second side of the reinforcement layer, wherein the reinforcement layer is made of a knitted material and comprises through openings through which the first layer and the second layer are adhered to each other.

[0046] In an embodiment, the method comprises the step of providing a further layer on the linoleum sheet.

[0047] In an embodiment, the step of providing a further layer on the linoleum sheet comprises the step of printing on the linoleum sheet.

[0048] In an embodiment, the step of providing a further layer on the linoleum sheet comprises the step of laminating the further layer on the linoleum sheet.

[0049] In an embodiment, the further layer is an acoustic layer and/or a self-adhesive layer. The acoustic layer may be provided to increase noise damping properties of the linoleum floor covering. A self-adhesive layer may be provided to facilitate the application of the linoleum floor covering on a sub-floor.

[0050] In an embodiment, the method comprises the step of cutting tiles or panels from the linoleum sheet. In an alternative embodiment, the linoleum sheet may be cut to size on the location where it is installed. Cutting may refer to any suitable cutting method such as die-cutting, waterjet cutting, laser cutting, ultrasonic cutting, etc.

[0051] Embodiments of the invention will now be described, by way of example only, with reference to the accompanying schematic drawings, in which:

Figure 1 shows an schematic cross-section of a linoleum floor covering according to an embodiment of the invention;
Figure 2 shows a cross section of the reinforcement layer of the schematic embodiment of Figure 1; and
Figure 3 discloses an example of a reinforcement layer according to an embodiment of the invention.

[0052] Figure 1 shows schematically an embodiment of a linoleum floor covering 1 generally denoted by reference numeral 1. The linoleum floor covering 1 comprises a first layer 2 of cured linoleum composition and a second layer 3 of cured linoleum composition. A reinforcement layer 4 is arranged between the first layer 2 and the second layer 3. The general advantage of such construction is that the reinforcement layer 4 is arranged between the first layer 2 and the second layer 3 which improves the dimensional stability and flexibility of the linoleum floor covering 1.

[0053] It is possible that the linoleum floor covering 1 comprises one or more additional layers on the first layer 2 and/or the second layer 3 at a side opposite to the reinforcement layer 4. One or more additional layers 6 on top of the second layer 3 are, as an example, indicated by dashed lines in Figure 1.

[0054] The one or more additional layers 6 may comprise an additional layer made of any suitable material to provide a desired function or characteristic to the linoleum floor covering 1. This additional layer 6 may for example be a primer layer to provide a flat top surface, a printed layer and/or a wear-resistant coating on the top side of the second layer 3. Correspondingly, an acoustic layer and/or a self-adhesive layer may be arranged on the bottom side of the first layer 2. The acoustic layer may be provided to increase noise damping properties of the linoleum floor covering. A self-adhesive layer may be provided to facilitate the application of the linoleum floor covering on a sub-floor.

[0055] The one or more additional layers 6 may also comprise an additional layer made a cured linoleum composition. For example, an additional layer made of a cured linoleum composition may be arranged on the first layer 2 or on the second layer 3 on the side opposite to the reinforcement layer 4. Further additional layers, made of a cured linoleum composition, or any suitable other material, may be arranged on the additional layer made of a cured linoleum composition arranged on the first layer 2 or the second layer 3. In practice, an upper side of the linoleum floor covering 1 will usually be covered by a wear-resistant coating on the top side.

[0056] The reinforcement layer 4 is separately shown in Figure 2. The reinforcement layer 4 comprises multiple through openings 5 that extend from the top side to the bottom side of the reinforcement layer 4. The through openings 5 are distributed in a regular pattern over the surface of the reinforcement layer 4. A combined surface area of the through openings 5 is at least 50% of the total surface are of the reinforcement layer 4. This provides a large open area formed by the through openings 5 through which the first layer 2 is bonded to the second layer 3.

[0057] The individual through openings 5 may have a surface area of 1 mm^2 to 10 mm^2, for example between 2 mm^2 and 6 mm^2. Openings of this size allow the materials of the first layer 2 and the second layer 3 to properly bond to each other.

[0058] Figure 1 shows that the first layer 2 and the second layer 3 are bonded to each other through the openings 5. There is no additional bonding/adhesive agent used to adhere the first layer 2 and/or the second layer

3 to the reinforcement layer 4 as used in linoleum floor coverings as described in WO 97/19219 and WO 97/44518.

[0059] As a result of the first layer 2 and the second layer 3 being bonded to each other through the through openings 5, the reinforcement layer 4 is enclosed between the first layer 2 and the second layer 3. The reinforcement layer 4 is however not used for bonding the first layer 2 and the second layer 3.

[0060] Since the reinforcement layer 4 is not used to adhere or bond the first layer 2 and the second layer 3, the reinforcement layer 4, the reinforcement layer 4 can be constructed differently than conventional carriers used in linoleum floor coverings that are used to adhere to the linoleum layers. This allows to improve the reinforcement layer 4 for other characteristics of the linoleum floor covering 1.

[0061] The reinforcement layer 4 is made of warp knitted mesh made by a wrap knitting technique. The warp knitting technique provides a knitted fabric comprising several yarns in which the wales and courses run roughly parallel to itself. The wale being a column of loops corresponding to the first direction of the reinforcement layer. Each course is a meandering row of loops, moving both with the direction of the wale and in a second direction of the reinforcement layer, interlocking to the wale loops at each crossing and connecting the individual columns of wale loops to each other. The first direction and the second direction are preferably perpendicular to each other. The first direction is for example a length direction of the reinforcement layer and the second direction a width direction of the reinforcement layer perpendicular to the length direction.

[0062] The thread filaments from which the knitted reinforcement layer 4 is made are for example polyester filaments, glass fibres, carbon fibres, and similar filament materials. The materials may be non-porous since the reinforcement layer 4 is not used for adhering the first layer 2 or second layer 3. The knitting materials preferably have a hydrophobicity which is the same or larger than a hydrophobicity of the first layer 2 and the second layer 3.

[0063] As the reinforcement layer 4 is made of knitted material with relatively large openings, the reinforcement layer 4 can be made with relatively low weight of less than 100g/m^2, for example 50 to 100 g/m^2. The mass percentage of the reinforcement layer 4 may for example be maximally 4% for a linoleum floor covering with a thickness <2.5 mm and maximally 3% for a linoleum floor covering with a thickness of $\geq$ 2.5 mm of the total weight of the linoleum floor covering 1.

[0064] Further, the use of a knitted material makes it possible to give the reinforcement layer 4 a constant thickness. The maximum thickness of the reinforcement layer may be in the range of 0.05 to 0.5 mm, for example between 0.2 and 0.4 mm. A constant thickness has the advantage that the linoleum floor covering is less susceptible for telegraphing due to thickness differences in the reinforcement layer. This has the additional advantage that the linoleum layers, i.e. the first layer 2 and the second layer 3, may be constructed with smaller thickness which generally improves the flexibility of the linoleum floor covering.

[0065] An additional advantage of the relatively thin and light reinforcement layer 4 is that the flammability of the linoleum floor covering 1 is substantially reduced. Linoleum materials have a low flammability, but the materials traditionally used for carrier layers have a relatively high flammability. Due to the low amount of material that is used for the reinforcement layer 4, and due to the location of the reinforcement layer being enclosed by the first layer 2 and the second layer 3, the fire resistance of the linoleum floor covering is substantially improved. Usually fire retardants are added to a linoleum floor covering to reduce the flammability, in particular to bring the flammability below a certain flammability score. In the linoleum floor covering 1 the amount of fire retardants to be added may be substantially reduced as a result of the improved fire resistance of the linoleum floor covering 1.

[0066] A further advantage of the relatively thin and light reinforcement layer 4 is that the linoleum floor covering 1 can be more easily cut to specific shapes or sizes. This is beneficial for a person installing the linoleum floor covering 1, for example to adjust the shape to a wall or other object, but also for cutting tiles or panels from a sheet of the linoleum floor covering 1.

[0067] Figure 3 shows an example of a knitted reinforcement layer having rectangular through openings.

[0068] The reinforcement layer is made by a warp knitting technique. The through openings in the reinforcement layer each have a surface area of about 1,25 mm^2 and have a combined surface area of about 60 % of the total surface area of the reinforcement layer. The thickness of the reinforcement layer is about 0.3 mm, and the mass of the reinforcement layer is about 85 g/mm^2.

Claims

1. A linoleum floor covering (1) comprising:

a first layer (2) of cured linoleum composition;
a second layer (3) of cured linoleum composition, and
a reinforcement layer (4) having multiple through openings (5) arranged between the first layer and the second layer,
wherein a combined surface area of the through openings is at least 50% of the total surface area of the reinforcement layer,
wherein the first layer (2) and second layer (3) are adhered to each other through the through openings (5), and
wherein the reinforcement layer (4) is made of knitted material.

2. The linoleum floor covering (1) of claim 1, wherein the reinforcement layer (4) is made of a warp knitted mesh comprising several yarns in which wales and courses run roughly parallel to itself, wherein each wale is a column of loops corresponding to the first direction of the reinforcement layer and each course is a meandering row of loops moving both with the first direction of the wale and in a second direction of the reinforcement layer, interlocking to the wale loops at each crossing and connecting the individual columns of wale loops to each other.

3. The linoleum floor covering (1) of claim 1 or 2, wherein each individual through opening (5) has a surface area of 1 mm^2 to 10 mm^2.

4. The linoleum floor covering (1) of any of the preceding claims, wherein the through openings (5) are distributed in a regular pattern over the reinforcement layer (4).

5. The linoleum floor covering (1) of any of the preceding claims, wherein the reinforcement layer (4) has a constant thickness.

6. The linoleum floor covering (1) of any of the preceding claims, wherein a maximum thickness of the reinforcement layer (4) is in the range of 0.05 to 0.5 mm.

7. The linoleum floor covering (1) of any of the preceding claims, wherein the mass percentage of the reinforcement layer (4) is maximally 3% of the total weight of the linoleum floor covering (1).

8. The linoleum floor covering (1) of any of the preceding claims, wherein the reinforcement layer (4) has a first tensile strength in a first direction and a second tensile strength in a second direction perpendicular to the first direction, wherein the first tensile strength is larger than the second tensile strength.

9. The linoleum floor covering (1) of any of the preceding claims, wherein the linoleum floor covering (1) is a shaped as a tile or a panel.

10. The linoleum floor covering (1) of any of the preceding claims, wherein the reinforcement layer (4) is made of a non-porous material.

11. The linoleum floor covering (1) of any of the preceding claims, wherein the reinforcement layer (4) is free of adhesive material to adhere the first layer (2) and/or the second layer (3) to the reinforcement layer.

12. The linoleum floor covering (1) of any of the preceding claims, wherein a hydrophobicity of the reinforcement layer (4) is the same or larger than a hydrophobicity of the first layer (2) and the second layer (3).

13. The linoleum floor covering (1) of any of the preceding claims, wherein the linoleum floor covering (4) comprises a third layer of cured linoleum composition, wherein the third layer is arranged on the first layer (2) or the second layer (3) at a side opposite to the reinforcement layer (4).

14. The linoleum floor covering (1) of any of the preceding claims, wherein the reinforcement layer has a mass of less than 100g/m^2.

15. A method for manufacturing of a linoleum floor covering (1) comprising the steps of:

providing a reinforcement layer (4) having multiple through openings (5) wherein the reinforcement layer is made of knitted material;
applying a first layer (2) of a linoleum composition at a first side of the reinforcement layer (4);
applying a second layer (3) of a linoleum composition at a second side of the reinforcement layer (4), wherein during the step of applying the second layer (3), the first layer (2) and the second layer (3) are adhered to each other through the openings (5) in the reinforcement layer (4); and
curing the first layer (2) and the second layer (3) of linoleum composition so as to form a linoleum sheet in which the first layer and the second layer are bonded together, wherein the reinforcement layer (4) is enclosed between the first layer and the second layer.

16. The method of claim 15, wherein the method comprises the step of providing a further layer (6) on the linoleum sheet, wherein, for example,

the step of providing a further layer on the linoleum sheet comprises the step of printing on the linoleum sheet and/or comprises the step of laminating the further layer on the linoleum sheet, and/or
wherein the further layer is an acoustic layer and/or a self-adhesive layer.

17. The method of claim 15 or 16, wherein the method comprises the step of cutting or punching tiles or panels from the linoleum sheet.

Figure 1

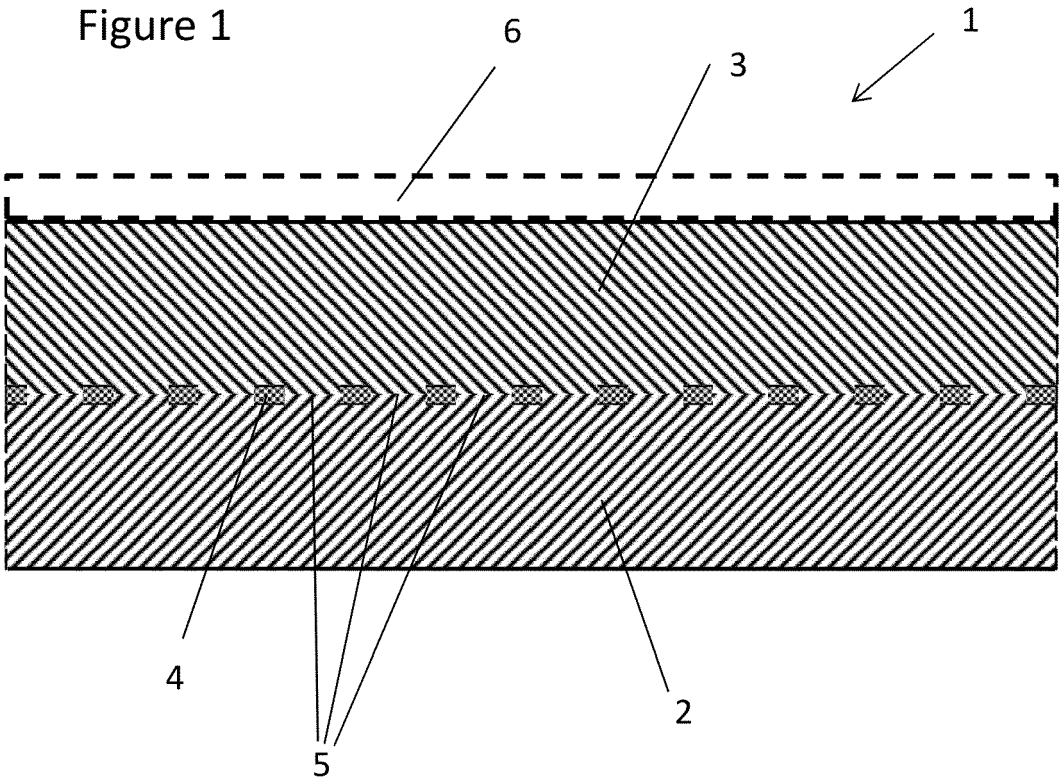


Figure 2

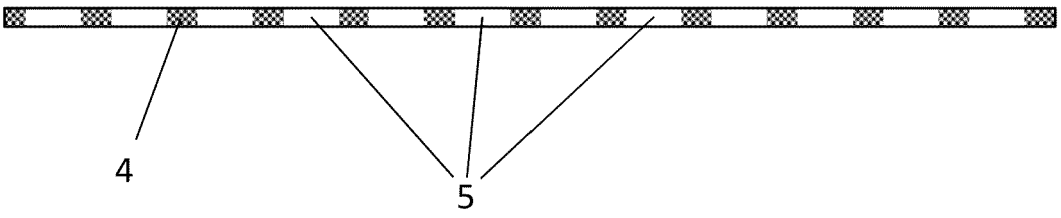
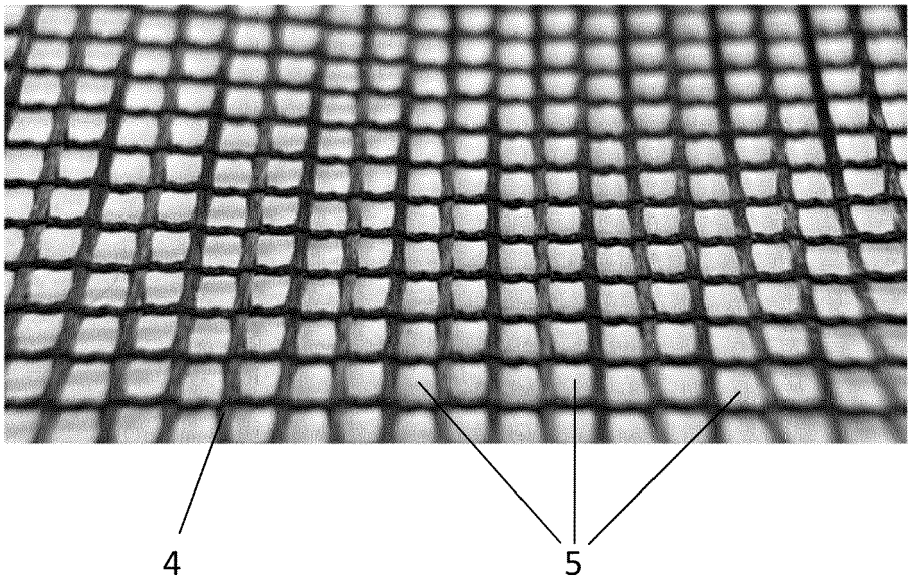


Figure 3



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Application Number
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Place of search	Date of completion of the search	Examiner
The Hague	24 March 2022	Van Beurden-Hopkins

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