

(19)



(11)

EP 3 307 614 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention
of the grant of the patent:

19.02.2020 Bulletin 2020/08

(51) Int Cl.:

B63B 29/02 ^(2006.01) **E04F 15/00** ^(2006.01)
E04B 1/94 ^(2006.01) **E04C 2/284** ^(2006.01)
E04C 2/32 ^(2006.01) **E04B 2/00** ^(2006.01)

(21) Application number: **16866586.7**

(86) International application number:

PCT/KR2016/012516

(22) Date of filing: **02.11.2016**

(87) International publication number:

WO 2017/086634 (26.05.2017 Gazette 2017/21)

(54) **FLAME RETARDANT TILE FOR SHIPS INCLUDING BIODEGRADABLE POLYMER**

FLAMMWIDRIGE FLIESE FÜR SCHIFFE MIT BIOLOGISCH ABBAUBAREM POLYMER

CARREAU IGNIFUGE POUR NAVIRES COMPRENANT UN POLYMÈRE BIODÉGRADABLE

(84) Designated Contracting States:

**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
PL PT RO RS SE SI SK SM TR**

• **KO, Hae Seung**
Gangseo-gu,
Seoul 07796, (KR)

(30) Priority: **19.11.2015 KR 20150162212**

(43) Date of publication of application:

18.04.2018 Bulletin 2018/16

(74) Representative: **Goddar, Heinz J.**

Boehmert & Boehmert
Anwaltpartnerschaft mbB
Pettenkoferstrasse 22
80336 München (DE)

(73) Proprietor: **LG Hausys, Ltd.**

Youngdungpo-gu
Seoul 07326 (KR)

(56) References cited:

JP-A- 2014 227 452 KR-A- 20110 123 920
KR-B1- 101 003 476 KR-B1- 101 003 476
KR-B1- 101 415 960 US-A1- 2014 107 241
US-A1- 2014 170 394 US-A1- 2014 170 394
US-B2- 7 670 545

(72) Inventors:

• **JANG, Woo Kyung**
Gangseo-gu,
Seoul 07796, (KR)

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

EP 3 307 614 B1

Description**Technical Field**

5 [0001] The present invention relates to a flame retardant tile for ships, and more particularly to a flame retardant tile for ships that may realize various appearances due to inclusion of a printed layer, is eco-friendly due to inclusion of a base layer and a transparent layer including a biodegradable resin, and is safe and exhibits superior flame retardancy due to reduction in smoke density and poisonous outgassing caused by combustion of a resin in case of fire.

10 **Background Art**

[0002] In general, a ship is completed into one structure by connecting blocks, which are manufactured using steel plates, to each other. An interior floor of a ship manufactured in this way is completed using a flooring material as in land-based structures.

15 [0003] As one type of such a flooring material, a compound having a sound insulation function is coated on a steel plate, thereby allowing maintenance of the appearance of the steel plate. However, in most cases, a separate flooring material is installed on the floor to complete a space in a ship.

[0004] Examining a flooring material for ships according to a conventional technology, the flooring material is constituted of a base material 110 having a constant height made of mineral wool and the finishing material 120 covering an upper part of the base material 110, as illustrated in FIG. 1. A flooring material 100 for ships has advantages such as excellent thermal and sound insulation properties due to mineral wool constituting of the base material 110 and excellent production cost reduction effect due to filling of an interior of the flooring material with mineral wool and completion of the same with the finishing material 120. However, the flooring material 100 for ships according to a conventional technology has a limitation in realizing an appearance.

25 [0005] Meanwhile, flame retardancy is most satisfactory in flooring materials to which a rubber material is applied. However, such flooring materials are expensive and also have limitations in realizing appearance.

[0006] In addition, a decorative tile made of a PVC material, which is cheap and may realize various appearances, may be considered as a flooring material for ships. However, such a decorative tile creates more poisonous gases, such as hydrogen chloride (HCl) gas, in case of combustion and exhibits a high smoke density. Accordingly, the properties of a decorative tile are too poor to obtain classification certification. Therefore, a decorative tile made of a PVC material could not be applied to a flooring material for ships.

[0007] In particular, when the decorative tile made of a PVC material is used in ships, smoke release amount is large in case of fire and secondary disasters, such as suffocation, due to poisonous gases in case of fire or firefighting may occur. Accordingly, in a situation in which interest in fire safety is high due to major accidents such as the recent Sewol Ferry accident and various fire accidents, it is difficult to apply the decorative tile made of a PVC material to a flooring material for ships.

[0008] Therefore, there is need for development of a flame retardant tile for ships that may realize various appearances, is eco-friendly, and is safe and exhibits superior flame retardancy due to reduction in smoke density and poisonous outgassing caused by combustion of a resin in case of fire.

40 [0009] An example of a conventional flooring material for ships is disclosed in Korean Patent Application Publication No. 10-2011-0123920.

[0010] Another example of interior sheets is disclosed in Korean Patent Application Publication No. 10-1003476.

[Related Art Document]

45

[0011] [Patent Document] (Patent Document 1)

[0012] KR 10-2011-0123920 A (November 16, 2011)

Disclosure of Invention

50

Technical Problem

[0013] Therefore, the present invention has been made in view of the above problems, and it is one object of the present invention to provide a flame retardant tile for ships that may realize various appearances due to inclusion of a printed layer, is eco-friendly due to inclusion of a base layer and a transparent layer including a biodegradable resin, and is safe and exhibits superior flame retardancy due to reduction in smoke density and poisonous outgassing caused by combustion of a resin in case of fire.

55

Solution to Problem

[0014] In accordance with one aspect of the present invention, provided is a flame retardant tile for ships including a base layer; a printed layer formed on the base layer; and a transparent layer formed on the printed layer.

Advantageous Effects of Invention

[0015] As apparent from the fore-going, the present invention advantageously provides a flame retardant tile for ships to realize various appearances by including a printed layer unlike conventional flooring materials for ships.

[0016] In addition, the flame retardant tile for ships according to the present invention includes a base layer and a transparent layer made of a biodegradable resin composition, thereby being eco-friendly. Further, the flame retardant tile lowers smoke density and poisonous gases created due to combustion of a resin in case of fire, thereby being safe and exhibiting superior flame retardancy.

Brief Description of Drawings

[0017]

FIG. 1 illustrates a perspective view of a conventional flooring material for ships.

FIG. 2 illustrates a schematic sectional view of a flame retardant tile for ships according to the present invention.

FIG. 3 illustrates a schematic sectional view of a particular embodiment of a flame retardant tile for ships according to the present invention.

Best Mode for Carrying out the Invention

[0018] Hereinafter, the present invention is described in detail with reference to the accompanying drawings.

[0019] FIG. 2 schematically illustrates a sectional view of a flame retardant tile for ships according to the present invention. As illustrated in FIG. 2, the present invention relates to a flame retardant tile for ships 1 including a base layer 20; a printed layer 30 formed on the base layer 20; and a transparent layer 40 formed on the printed layer 30.

[0020] The base layer 20 of the present invention is characterized by being formed of a resin composition including a polylactic acid (PLA) resin, an inorganic flame retardant, and a filler so as to exhibit superior flame retardancy while being eco-friendly without deteriorating the properties of a tile.

[0021] The PLA resin may be, for example, a biodegradable resin prepared by lactic acid fermentation of vegetable starch. When a flame retardant tile for ships is manufactured using such a PLA resin, the flame retardant tile is eco-friendly and exhibits reduced poisonous gas emission and smoke density in case of fire, thereby being safe in case of fire. The content of the PLA resin in the resin composition forming the base layer 20 is 5 to 25% by weight, more preferably 10 to 20% by weight. When the content of the PLA resin is less than 5% by weight, eco-friendly effects and poisonous gas emission and smoke density reduction effects thereof in case of fire may be weak. On the other hand, when the content of the PLA resin is greater than 25% by weight, dimensional stability is poor and, due to a drawback, i.e., narrow processing and service temperature ranges, of the PLA resin, the properties of the flame retardant tile for ships may be deteriorated. Therefore, the PLA resin is preferably included within the above range.

[0022] The inorganic flame retardant may be a metal hydroxide such as magnesium hydroxide, aluminum hydroxide, barium hydroxide, or calcium hydroxide, a metallic oxide such as aluminum oxide, iron oxide, titanium oxide, manganese oxide, magnesium oxide, zirconium oxide, zinc oxide, molybdenum oxide, cobalt oxide, bismuth oxide, chromium oxide, tin oxide, nickel oxide, copper oxide, or tungsten oxide, a metal powder such as aluminum, iron, copper, nickel, titanium, manganese, tin, zinc, molybdenum, cobalt, bismuth, chromium, tungsten, or antimony, a carbonate such as zinc carbonate, magnesium carbonate, calcium carbonate, or barium carbonate, or the like. Alternatively, any one or a mixture of two or more of these substances may be used. Preferably, a metal hydroxide, a smoke release amount of which is small during combustion and which releases water (H₂O) at high temperature, is used as the inorganic flame retardant. Particularly preferably, aluminum hydroxide or magnesium hydroxide is used as the inorganic flame retardant. The content of the inorganic flame retardant in the resin composition forming the base layer is 10 to 40% by weight, more preferably 15 to 25% by weight. When the content of the inorganic flame retardant is less than 10% by weight, flame retardancy effect is slight. On the other hand, when the content of the inorganic flame retardant is greater than 40% by weight, processability and other properties of the flame retardant tile for ships may be deteriorated. Accordingly, the inorganic flame retardant is preferably included within the above range.

[0023] As the filler, one or more selected from the group consisting of calcium carbonate, talc, fly ash, blast furnace slag, and a combination thereof may be used. Preferably, calcium carbonate is used as the filler because there are advantages in terms of cost and versatility and heat resistance and durability may be increased. The content of the filler

in the resin composition forming the base layer is 30 to 70% by weight, more preferably 40 to 65% by weight. When the content of the filler is less than 30% by weight, the cost of a tile may increase and heat resistance and durability may be decreased. On the other hand, when the content of the filler is greater than 70% by weight, processability may be decreased. Accordingly, the filler is preferably included within the above range.

[0024] The resin composition forming the base layer 20 according to the present invention may further include a thermoplastic polyurethane resin to have flame retardancy and processability. The content of the thermoplastic polyurethane resin in the resin composition forming the base layer 20 is preferably 1 to 15% by weight, more preferably 1 to 10% by weight. When the content of the thermoplastic polyurethane resin is less than 1%, it is difficult to provide flexibility to a tile due to the properties of the PLA resin. On the other hand, when the content of the thermoplastic polyurethane resin is greater than 15% by weight, flexibility may be exhibited, but problems related to dimensional stability and smoke generation may occur. Accordingly, the thermoplastic polyurethane resin is preferably included within the above range.

[0025] In addition, the resin composition forming the base layer 20 according to the present invention may further include any one or more selected from among a plasticizer, a processing aid, and a lubricant, to have processability.

[0026] As the plasticizer, a benzoate-based, citrate-based, or phosphate-based plasticizer may be used. The content of the plasticizer in the resin composition forming the base layer may be 1 to 5% by weight.

[0027] As the processing aid for supplementing processability and melt strength, an acrylic copolymer may be used. The content of the processing aid in the resin composition forming the base layer may be 1 to 5% by weight.

[0028] The lubricant may be used to prevent a resin composition for forming the base layer from adhering to a calender or a presser when the base layer is processed by calender molding, press molding, or the like. As the lubricant, a higher fatty acid, such as stearic acid, may be used. The content of the lubricant in the resin composition forming the base layer may be 0.01 to 1% by weight.

[0029] The thickness of the base layer may be 1 to 5 mm.

[0030] The printed layer 30 formed on the base layer 20 according to the present invention provides various printing patterns to the flame retardant tile for ships. Here, the printed layer 30 may be formed by, after forming a white sheet 31, providing the printed pattern 32 to a surface of the white sheet 31 by a method such as reproduction proof printing, gravure printing, screen printing, offset printing, rotary printing, or flexo printing (see FIG. 3). The white sheet 31, which is a white sheet, makes the printed pattern 32 or a pattern formed thereon clear and may allow superior durability realization by increasing adhesion of the base layer 20 laminated thereunder. The thickness of the white sheet 31 may be 0.1 to 0.3 mm, but the present invention is not limited thereto. In addition, the printed layer 30 may be formed using another transparent sheet or colored sheet, other than the white sheet 31.

[0031] Selectively, the printed layer 30 may be directly formed on the base layer 20 by reproduction proof printing, gravure printing, or screen printing. In this case, since the printed layer 30, which is an ink layer formed by printing, is too thin to measure the thickness thereof and not to affect a total thickness of the flame retardant tile for ships according to the present invention, the thickness of the printed layer 30 may be disregarded.

[0032] Such a printed layer 30 provides a pattern by printing and thus exhibits an appearance and design having superior aesthetics. Accordingly, the flame retardant tile for ships of the present invention may realize various designs while overcoming limitations of conventional flooring materials in realizing various appearances.

[0033] The transparent layer 40 formed on the printed layer 30 according to the present invention protects the printed pattern or a pattern of the printed layer 30 and provides flame retardancy to the flame retardant tile for ships.

[0034] The transparent layer 40 of the present invention is characterized by being prepared using a resin composition including a biodegradable polymer resin and a phosphorus flame retardant.

[0035] The biodegradable polymer resin is not specifically limited so long as it is biodegradable. Preferably, the biodegradable polymer resin is one or more selected from among a polylactic acid (PLA) resin, a polyglycolic acid resin, a polycaprolactone resin, an aliphatic polyester resin, a polyhydroxybutyric acid resin, and a D-3-hydroxy butyric acid resin. Here, the biodegradable resin is most preferably a PLA resin exhibiting properties similar to those of commercial resins such as a polypropylene (PP) resin and a polyethylene terephthalate (PET) resin. The content of the biodegradable resin in the resin composition forming the transparent layer 40 is preferably 40 to 75% by weight, preferably 50 to 70% by weight. When the content of the biodegradable polymer resin is less than 40% by weight, eco-friendly effects and poisonous gas emission and smoke density reduction effects thereof in case of fire may be weak. On the other hand, when the content of the biodegradable polymer resin is greater than 75% by weight, the properties of the flame retardant tile for ships may be deteriorated. Accordingly, the biodegradable polymer resin is preferably included within the above range.

[0036] As the phosphorus flame retardant, any one or a mixture of two or more selected from among a phosphate compound, a phosphonate compound, a phosphinate compound, and a phosphazene compound may be used.

[0037] Particular examples of the phosphate compound include triphenyl phosphate, tricresyl phosphate, cresyl diphenyl phosphate, trixylyl phosphate, tri(2,4,6-trimethylphenyl)phosphate, tri(2,4-di-*t*-butylphenyl)phosphate, tri(2,6-di-*t*-butylphenyl)phosphate, resorcinol bis(diphenyl phosphate), hydroquinone bis(diphenyl phosphate), bisphenol A-

bis(diphenyl phosphate), resorcinol bis(2,6-di-*t*-butylphenyl phosphate), hydroquinone bis(2,6-dimethylphenyl phosphate), and the like. These substances may be used alone or as a mixture of two or more thereof.

[0038] Particular examples of the phosphonate compound include aluminum methyl methylphosphonate, cyclic phosphonate, and the like. These substances may be used alone or as a mixture of two or more thereof.

[0039] Particular examples of the phosphinate compound include aluminum di-ethylphosphinate, aluminum methyl-ethylphosphinate, and the like. These substances may be used alone or as a mixture of two or more thereof.

[0040] Particular examples of the phosphazene compound include hexaphenoxytricyclopophosphazene.

[0041] As the phosphorus flame retardant, the biodegradable polymer compound and a phosphate compound is preferred because it has compatibility (transparency, plasticity, and the like) with the biodegradable polymer. In terms of volatility and price competitiveness, resorcinol bis (diphenyl phosphate) or bisphenol A-bis (diphenyl phosphate) is more preferred.

[0042] The content of the phosphorus flame retardant in the resin composition forming the transparent layer 40 is preferably 10 to 30% by weight, more preferably 10 to 25% by weight. When the content of the phosphorus flame retardant is less than 10% by weight, flame retardancy and plasticity are decreased. On the other hand, when the content of the phosphorus flame retardant is greater than 30% by weight, the properties of the flame retardant tile for ship may be deteriorated. Accordingly, the phosphorus flame retardant is preferably included within the above range.

[0043] The resin composition forming the transparent layer 40 according to the present invention may further include one or more selected from among a processing aid, an epoxy resin, an antiblocking agent, a lubricant, and other additives for increasing transparency, processability, and shelf life.

[0044] As the processing aid, an acrylic copolymer for supplementing transparency, processability, and melt strength may be used. The content of the processing aid in the resin composition forming the transparent layer may be 10 to 30% by weight, preferably 15 to 25% by weight.

[0045] The epoxy resin is added to provide transparency. The content of the epoxy resin in the resin composition forming the transparent layer may be 0.1 to 5% by weight.

[0046] The antiblocking agent is added to prevent a blocking phenomenon wherein surfaces of films adhere to each other upon winding after processing. As the antiblocking agent, one or more selected from among silica, diatomite, kaolin, and talc may be used. The content of the antiblocking agent in the resin composition forming the transparent layer may be 0.1 to 5% by weight.

[0047] The lubricant may be used to prevent the resin composition for forming a transparent layer from adhering to a calender or presser upon processing of the transparent layer 40 by calender molding, press molding, or the like. As the lubricant, a higher fatty acid, such as stearic acid, may be used. The content of the lubricant in the resin composition forming the transparent layer may be 0.1 to 5% by weight.

[0048] Examples of the other additives include an antioxidant, an antistatic agent, a UV light stabilizer, an anti-hydrolysis agent, and the like. The content of the other additives in the resin composition forming the transparent layer may be 0.1 to 5% by weight.

[0049] The thickness of the transparent layer may be 0.1 to 1 mm.

[0050] Since the transparent layer 40 of the present invention includes the phosphorus flame retardant, char is formed on a surface of the transparent layer 40 in case of combustion. In addition, radicals are generated due to thermal decomposition and thus H or OH radicals are captured, thereby providing flame retardancy.

[0051] Meanwhile, an easy layer 10 may be selectively, further formed under the base layer 20 of the flame retardant tile for ships according to the present invention (FIG. 3). The easy layer 10, which is a part that adheres to a floor surface upon construction, protects the lowest part of the flame retardant tile, obstructs moisture at the bottom, and keeps overall curling balance of the tile. The easy layer 10 may include a PVC or PLA resin and a filler (i.e., calcium carbonate).

[0052] The thickness of the easy layer 10 may be 0.1 to 3 mm.

[0053] In addition, a surface treatment layer (not shown) may be selectively, further formed on the highest layer of the flame retardant tile for ships of the present invention.

[0054] That is, the surface treatment layer may be formed on the transparent layer 40 and protects the tile from initial contamination, i.e., adherence of contaminants, while improving scratch resistance and wear resistance. The surface treatment layer may be generally formed by coating a coating solution wherein a thermosetting or UV curable compound is dissolved in a solvent. However, since, in the case of the thermosetting compound, the properties of other layers locating at a lower part, particularly the transparent layer 40 and the base layer 20, may be changed when heat is applied to form the surface treatment layer, an UV curable compound is more preferred. Here, as the UV curable compound, a monomer or an oligomer having one or more functional groups, such as a crosslinkable unsaturated linking group, may be used. For example, urethane acrylate, epoxy acrylate, polyether acrylate, polyester acrylate, dipentaerythritol hexaacrylate, dipentaerythritol pentaacrylate, pentaerythritol tetraacrylate, dipentaerythritol hexaacrylate, dipentaerythritol pentaacrylate, or the like may be used. However, these substances are only provided as examples and the present invention is not limited thereto. As the UV curable compound of the present invention, these substances may be used alone or as a mixture of two or more thereof. The coating solution including the UV curable compound generally includes

a photopolymerization initiator other than the UV curable compound and a solvent. As needed, various additives, such as a photostabilizer and a leveling agent, may be included within a range within which the properties of the surface treatment layer are not changed. The surface treatment layer has a surface hardness of 7 H or more measured by a pencil hardness test. At this surface hardness, a plastic film exhibits a superior surface hardness. More preferably, the surface hardness is controlled within a range of 7H to 8H. The UV curable compound constituting the surface treatment layer may be preferably a general photocurable urethane acrylate.

[0055] The thickness of the surface treatment layer may be 5 to 40 μm .

[0056] The transparent layer 40, the white sheet 31, the base layer 20, and the easy layer 10 of the flame retardant tile for ships according to the present invention may be manufactured by calender molding, casting molding, blow molding, extrusion molding, or the like.

[0057] Calender molding is a method of continuously producing a sheet or a film by rolling a raw material between two or more rolls rotating in opposite directions, casting molding is a method of multilayer-coating a release paper, which is easily delaminated and has superior heat resistance, with synthetic resin sol and then laminating, blow molding is a method of manufacturing a hollow container by inserting parison, which has been prepared by heating and melting a thermoplastic resin and continuously extruding the same in a tubular shape by means of an extruder, into one or more molds, closing lids, and sealing upper and lower parts of the molds and then blowing air into the parison in a mandrel such that the parison is expanded and thus adheres to inner walls of the molds, and extrusion molding is a method of heating and melting a thermoplastic plastic material on a surface of a base by means of an extruder such that the thermoplastic plastic material is present at a flow state, and then extruding the thermoplastic plastic material into a film shape on a T-die while continuously pressing the same.

[0058] Preferably, the calender molding is used because the contents of components, such as additives, may be freely controlled compared to other manufacturing methods and thus a flooring material having superior flexibility, impact resistance, mechanical strength, processability, fitness, and melting efficiency may be provided. In addition, the raw material costs may be reduced. Accordingly, the calender molding method is preferred.

[0059] In addition, each of the layers of the flame retardant tile for ships according to the present invention may be formed by being laminated through application of heat and pressure using a lamination process known in the art.

[0060] Now, the present invention will be described in more detail with reference to the following preferred examples. It is obvious to those skilled in the art that these examples are provided for illustrative purposes only and various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention. In addition, it is obvious that such modifications, additions and substitutions are within the scope of the appended claims.

[Example]

(Preparation of transparent layer)

[0061] 60% by weight of PLA resin, 18% by weight of resorcinol bis(diphenyl phosphate), 18% by weight of an acrylic copolymer, 1% by weight of an epoxy resin, 1% by weight of an antiblocking agent, 1% by weight of higher fatty acid, and 1% by weight of other additives were kneaded by means of a Banbury mixer and then subjected to first and second mixing by means of a 2 roll machine, thereby preparing a composition for forming a transparent layer. Subsequently, the composition for preparing a transparent layer was subjected to calender molding at 150°C, thereby preparing a transparent layer (film) having a thickness of 0.3 mm.

(Preparation of printed layer)

[0062] 45% by weight of PLA resin, 9% by weight of ATBC, 7% by weight of an acryl copolymer, 1% by weight of stearic acid, as higher fatty acid, diisocyanate, 31% by weight of calcium carbonate, and 7% by weight of titanium dioxide were mixed by means of a Banbury mixer and then subjected to first and second mixing by means of a 2 roll machine. Subsequently, a prepared material was subjected to calender molding at 150°C, thereby preparing a white sheet having a thickness of 0.15 mm. In addition, a printed pattern was formed on a white sheet surface by gravure printing or reproduction proof printing, thereby preparing a printed layer.

(Preparation of base layer)

[0063] 12% by weight of PLA resin, 5% by weight of thermoplastic polyurethane resin, 3% by weight of a plasticizer, 3% by weight of an acrylic copolymer, 0.1% by weight of higher fatty acid, 56% by weight of calcium carbonate, and 20.9% by weight of aluminum hydroxide were kneaded by means of a Banbury mixer and then subjected to first and second mixing by means of a 2 roll machine, thereby preparing a composition for preparing a base layer.

[0064] Subsequently, the composition for preparing a base layer was subjected to calender molding at 150°C, thereby

preparing a base layer having a thickness of 1.7 mm.

(Preparation of easy layer)

[0065] 43% by weight of PLA resin, 5% by weight of ATBC, 6% by weight of an acryl copolymer, 1% by weight of stearic acid, as higher fatty acid, 43% by weight of calcium carbonate, 1% by weight of titanium dioxide, and 1% by weight of a pine resin were kneaded by means of a Banbury mixer and then subjected to first and second mixing by means of a 2 roll machine. Subsequently, a prepared raw material was subjected to calender molding at 140 to 180°C, thereby preparing an easy layer having a thickness of 0.25 mm.

[0066] The prepared transparent layer, printed layer, base layer, and easy layer were sequentially stacked and then laminated through application of heat and pressure using a lamination process, thereby preparing a flame retardant tile for ships. A sectional view of the flame retardant tile for ships according to the example is schematically illustrated in FIG. 3.

Experimental Example 1

[0067] Flame propagation indexes, a smoke density, and poisonous gases of the flame retardant tile for ships of the example were measured. Measurement methods are as follows.

[0068] Smoke density and poisonous gas measurement methods were carried out according to ISO 5659-2 combustion chamber test methods. Test results are summarized in Table 1 to Table 3 below.

[Table 1]

Specimen no Items	1	2	3	Average	Surface flammability criteria
Average heat for sustained burning, Q_{ab} (MJ/m ²)	1.00	0.99	1.01	1.00	≥ 0.25
Critical flux at extinguishment, CFE (kW/m ²)	7.28	7.28	6.80	7.12	≥ 7.0
Total heat release, Q_c (MJ)	0.96	0.90	0.95	0.94	≤ 2.0
Peak heat release rate, Q_p (MW)	6.70	7.62	7.54	7.29	≤ 10.0
Burning droplets	2	1	1	2	Not more than 10 burning drops

※ Note 1) This criteria is for Surface Materials (Floor coverings).

[Table 2]

Condition Item	Irradiance to the specimen	25 (KW/m ²)	25 (KW/m ²)	50 (KW/m ²)	Smoke Criteria	
	Pilot flame	Absence	Presence	Absence	Materials	D _m
Results of smoke test	Average of maximum specific optical density (D _m)	362.6	111.7	308.1	bulkheads linings, ceilings	Not exceed 200
					primary deck covering	Not exceed 400
					floor covering	Not exceed 500
					Plastic pipes electric cables	Not exceed 400

[Table 3]

Condition Item	Irradiance to the specimen	25 (KW/m ²)	25 (KW/m ²)	50 (KW/m ²)	Toxicity Criteria
	Pilot flame	Absence	Presence	Absence	
Results of toxicity test (ppm)	CO	1206.1	806.6	1008.8	≤1,450
	HCN	5.1	N.D.	N.D.	≤140
	HCl	N.D.	N.D.	N.D.	≤600
	HBr	N.D.	N.D.	N.D.	≤600
	HF	N.D.	N.D.	N.D.	≤600
	NOx	N.D.	N.D.	N.D.	≤350
	SO ₂	N.D.	N.D.	N.D.	≤120

[0069] As shown in Table 1 to Table 3, it can be confirmed that the flame retardant tile for ships according to the present invention meets all of flame retardant performance criteria for classification certificate issued by International Maritime Organization (IMO). In addition, it can be confirmed that, since the flame retardant tile for ships according to the present invention includes the biodegradable resin composition, the flame retardant tile decreases the density of smoke and poisonous gases created due to combustion of a resin in case of fire, thus being safe and having superior flame retardancy. Further, it can be confirmed that, since the flame retardant tile for ships according to the present invention includes the printed layer, various appearances may be realized.

[Description of Symbols]

[0070]

- 1: flame retardant tile for ships
- 10: easy layer
- 20: base layer
- 30: printed layer
- 31: white sheet
- 32: printed pattern
- 40: transparent layer

50: surface treatment layer
 100: conventional flooring material for ships
 110: base material
 120: finishing material

Claims

1. A flame retardant tile for ships (1), comprising:

a base layer (20);
 a printed layer (30) formed on the base layer (20); and
 a transparent layer (40) formed on the printed layer (30), **characterized in that**
 the base layer(20) is formed of a resin composition comprising 5 to 25% by weight of a polylactic acid (PLA) resin, 10 to 40% by weight of an inorganic flame retardant, and 30 to 70% by weight of a filler.

2. The flame retardant tile according to claim 1, wherein the inorganic flame retardant includes one or more selected from among metal hydroxides consisting of magnesium hydroxide, aluminum hydroxide, barium hydroxide and calcium hydroxide.

3. The flame retardant tile according to claim 1, wherein the resin composition forming the base layer (20) further comprises one or more selected from among a thermoplastic polyurethane resin, a plasticizer, a processing aid, and a lubricant.

4. The flame retardant tile according to claim 3, wherein the resin composition forming the base layer (20) comprises 1 to 15% by weight of the thermoplastic polyurethane resin.

5. The flame retardant tile according to claim 1, wherein the transparent layer (40) is formed of a resin composition comprising a biodegradable polymer resin and a phosphorus flame retardant.

6. The flame retardant tile according to claim 5, wherein the biodegradable polymer resin is one or a mixture of two or more selected from among a polylactic acid (PLA) resin, a polyglycolic acid resin, a polycaprolactone resin, an aliphatic polyester resin, a polyhydroxybutyric acid resin, and a D-3-hydroxy butyric acid resin.

7. The flame retardant tile according to claim 5, wherein the phosphorus flame retardant is one or a mixture of two or more selected from among a phosphate compound, a phosphonate compound, a phosphinate compound, and a phosphazene compound.

8. The flame retardant tile according to claim 7, wherein the phosphate compound is triphenyl phosphate, tricresyl phosphate, cresyl diphenyl phosphate, trixylyl phosphate, tri(2,4,6-trimethylphenyl)phosphate, tri(2,4-di-t-butylphenyl)phosphate, tri(2,6-di-t-butylphenyl)phosphate, resorcinol bis(diphenyl phosphate), hydroquinone bis(diphenyl phosphate), bisphenol A-bis(diphenyl phosphate), resorcinol bis(2,6-di-t-butylphenyl phosphate), or hydroquinone bis(2,6-dimethylphenyl phosphate).

9. The flame retardant tile according to claim 5, wherein the resin composition forming the transparent layer (40) is formed of a resin composition comprising 40 to 75% by weight of a biodegradable polymer resin and 10 to 30% by weight of a phosphorus flame retardant.

10. The flame retardant tile according to claim 5, wherein the resin composition forming the transparent layer (40) further comprises any one or more selected from among a processing aid, an epoxy resin, an antiblocking agent, a lubricant, and other additives.

11. The flame retardant tile according to claim 10, wherein the resin composition forming the transparent layer (40) comprises 10 to 30% by weight of the processing aid, an epoxy resin 0.1 to 5% by weight, 0.1 to 5% by weight of the antiblocking agent, 0.1 to 5% by weight of the lubricant, 0.1 to 5% by weight of other additives.

12. The flame retardant tile according to claim 1, wherein a thickness of the transparent layer (40) is 0.1 to 1 mm.

13. The flame retardant tile according to claim 1, wherein an easy layer (10) is further formed under the base layer (20).
14. The flame retardant tile according to claim 1, wherein a surface treatment layer (50) is further formed on the transparent layer (40).

Patentansprüche

1. Flammhemmende Fliese für Schiffe (1), umfassend:

eine Basisschicht (20);
eine gedruckte Schicht (30), die auf der Basisschicht (20) gebildet ist; und
eine transparente Schicht (40), die auf der gedruckten Schicht (30) gebildet ist, **dadurch gekennzeichnet, dass**
die Basisschicht (20) aus einer Harzzusammensetzung gebildet ist, die 5 bis 25 Gew.-% eines Polymilchsäureharzes (PLA), 10 bis 40 Gew.-% eines anorganischen Flammhemmstoffs und 30 bis 70 Gew.-% eines Füllstoffs umfasst.

2. Flammhemmende Fliese nach Anspruch 1, wobei der anorganische Flammhemmstoff eines oder mehrere einschließt, ausgewählt aus Metallhydroxiden bestehend aus Magnesiumhydroxid, Aluminiumhydroxid, Bariumhydroxid und Calciumhydroxid.

3. Flammhemmende Fliese nach Anspruch 1, wobei die Harzzusammensetzung, die die Basisschicht (20) bildet, ferner eines oder mehrere umfasst, ausgewählt aus einem thermoplastischen Polyurethanharz, einem Weichmacher, einer Verarbeitungshilfe und einem Gleitmittel.

4. Flammhemmende Fliese nach Anspruch 3, wobei die Harzzusammensetzung, die die Basisschicht (20) bildet, 1 bis 15 Gew.-% des thermoplastischen Polyurethanharzes umfasst.

5. Flammhemmende Fliese nach Anspruch 1, wobei die transparente Schicht (40) aus einer Harzzusammensetzung gebildet ist, die ein bioabbaubares Polymerharz und einen Phosphorflammhemmstoff umfasst.

6. Flammhemmende Fliese nach Anspruch 5, wobei das bioabbaubare Polymerharz eines oder eine Mischung aus zwei oder mehreren ist, ausgewählt aus einem Polymilchsäureharz (PLA), einem Polyglykolsäureharz, einem Polycaprolactonharz, einem aliphatischen Polyesterharz, einem Polyhydroxybuttersäureharz und einem D-3-Hydroxybuttersäureharz.

7. Flammhemmende Fliese nach Anspruch 5, wobei der Phosphorflammhemmstoff eines oder eine Mischung aus zwei oder mehreren ist, ausgewählt aus einer Phosphatverbindung, einer Phosphonatverbindung, einer Phosphinatverbindung und einer Phosphazenverbindung.

8. Flammhemmende Fliese nach Anspruch 7, wobei die Phosphatverbindung Triphenylphosphat, Tricresylphosphat, Cresyldiphenylphosphat, Trixylylphosphat, Tri(2,4,6-trimethylphenyl)phosphat, Tri(2,4-di-t-butylphenyl)phosphat, Tri(2,6-di-t-butylphenyl)phosphat, Resorcinol-bis(diphenylphosphat), Hydrochinon-bis(diphenylphosphat), Bisphenol-A-bis(diphenylphosphat), Resorcinol-bis(2,6-di-t-butylphenylphosphat) oder Hydrochinon-bis(2,6-dimethylphenylphosphat) ist.

9. Flammhemmende Fliese nach Anspruch 5, wobei die Harzzusammensetzung, die die transparente Schicht (40) bildet, aus einer Harzzusammensetzung gebildet ist, die 40 bis 75 Gew.-% eines bioabbaubaren Polymerharzes und 10 bis 30 Gew.-% eines Phosphorflammhemmstoffs umfasst.

10. Flammhemmende Fliese nach Anspruch 5, wobei die Harzzusammensetzung, die die transparente Schicht (40) bildet, ferner eines oder mehrere umfasst, ausgewählt aus einer Verarbeitungshilfe, einem Epoxyharz, einem Antiblockiermittel, einem Gleitmittel und anderen Additiven.

11. Flammhemmende Fliese nach Anspruch 10, wobei die Harzzusammensetzung, die die transparente Schicht (40) bildet, 10 bis 30 Gew.-% der Verarbeitungshilfe, 0,1 bis 5 Gew.-% Epoxyharz, 0,1 bis 5 Gew.-% des Antiblockiermittels, 0,1 bis 5 Gew.-% des Gleitmittels, 0,1 bis 5 Gew.-% andere Additive umfasst.

12. Flammhemmende Fliese nach Anspruch 1, wobei eine Dicke der transparenten Schicht (40) 0,1 bis 1 mm ist.
13. Flammhemmende Fliese nach Anspruch 1, wobei eine Leichtsicht (10) ferner unter der Basisschicht (20) gebildet ist.
14. Flammhemmende Fliese nach Anspruch 1, wobei eine Oberflächenbehandlungsschicht (50) ferner auf der transparenten Schicht (40) gebildet ist.

Revendications

1. Carreau ignifuge pour navires (1), comprenant :

une couche de base (20) ;
 une couche imprimée (30) formée sur la couche de base (20) ; et
 une couche transparente (40) formée sur la couche imprimée (30),
caractérisé en ce que la couche de base (20) est formée d'une composition de résine comprenant entre 5 et 25 % en poids d'une résine d'acide polylactique (PLA), entre 10 et 40 % en poids d'un agent ignifuge inorganique et entre 30 et 70 % en poids d'une charge.

2. Carreau ignifuge selon la revendication 1, dans lequel l'agent ignifuge inorganique inclut un ou plusieurs éléments sélectionnés parmi des hydroxydes métalliques constitués de hydroxyde de magnésium, hydroxyde d'aluminium, hydroxyde de baryum et hydroxyde de calcium.

3. Carreau ignifuge selon la revendication 1, dans lequel la composition de résine formant la couche de base (20) comprend en outre un ou plusieurs éléments sélectionnés parmi une résine polyuréthane thermoplastique, un plastifiant, un auxiliaire de traitement et un lubrifiant.

4. Carreau ignifuge selon la revendication 3, dans lequel la composition de résine formant la couche de base (20) comprend entre 1 et 15 % en poids de la résine polyuréthane thermoplastique.

5. Carreau ignifuge selon la revendication 1, dans lequel la couche transparente (40) est formée d'une composition de résine comprenant une résine polymère biodégradable et un agent ignifuge au phosphore.

6. Carreau ignifuge selon la revendication 5, dans lequel la résine polymère biodégradable est une résine ou un mélange de deux ou plus de deux résines sélectionnées parmi une résine d'acide polylactique (PLA), une résine d'acide polyglycolique, une résine de polycaprolactone, une résine de polyester aliphatique, une résine d'acide polyhydroxybutyrique et une résine d'acide hydroxybutyrique D-3.

7. Carreau ignifuge selon la revendication 5, dans lequel l'agent ignifuge au phosphore est un mélange de deux ou plus de deux composés sélectionnés parmi un composé de phosphate, un composé de phosphonate, un composé de phosphinate et un composé de phosphazène.

8. Carreau ignifuge selon la revendication 7, dans lequel le composé de phosphate est un phosphate de triphényle, phosphate de tricrésyle, phosphate de crésyldiphényle, phosphate de trixyle, phosphate de tri(2,4,6-triméthylphényle), phosphate de tri(2,4-di-t-butylphényle), phosphate de tri(2,6-di-t-butylphényle), résorcinol bis(phosphate de diphenyle), hydroquinone bis(phosphate de diphenyle), bisphénol A-bis(phosphate de diphenyle), résorcinol bis(2,6-di-t-butylphényle phosphate) ou hydroquinone bis(2,6-diméthylphényle phosphate).

9. Carreau ignifuge selon la revendication 5, dans lequel la composition de résine formant la couche transparente (40) est formée d'une composition de résine comprenant entre 40 et 75 % en poids d'une résine polymère biodégradable et entre 10 et 30 % en poids d'un agent ignifuge au phosphore.

10. Carreau ignifuge selon la revendication 5, dans lequel la composition de résine formant la couche transparente (40) comprend en outre un ou plusieurs éléments sélectionnés parmi un auxiliaire de traitement, une résine époxy, un agent anti-adhérent, un lubrifiant et d'autres additifs.

11. Carreau ignifuge selon la revendication 10, dans lequel la composition de résine formant la couche transparente

EP 3 307 614 B1

(40) comprend entre 10 et 30 % en poids d'un auxiliaire de traitement, une résine époxy entre 0,1 et 5 % en poids, entre 0,1 et 5 % en poids de l'agent anti-adhérent, entre 0,1 et 5 % en poids du lubrifiant, entre 0,1 et 5 % en poids d'autres additifs.

- 5 **12.** Carreau ignifuge selon la revendication 1, dans lequel une épaisseur de la couche transparente (40) est comprise entre 0,1 et 1 mm.
- 10 **13.** Carreau ignifuge selon la revendication 1, dans lequel une couche facile (10) est en outre formée sous la couche de base (20).
- 10 **14.** Carreau ignifuge selon la revendication 1, dans lequel une couche de traitement de surface (50) est en outre formée sur la couche transparente (40).

15

20

25

30

35

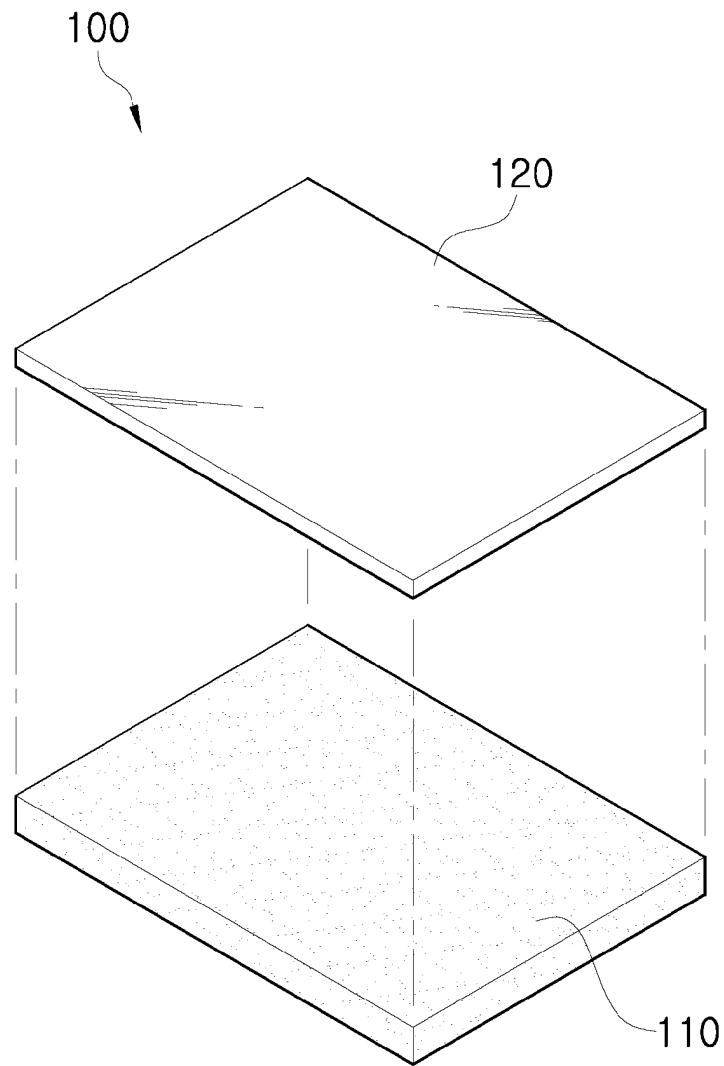
40

45

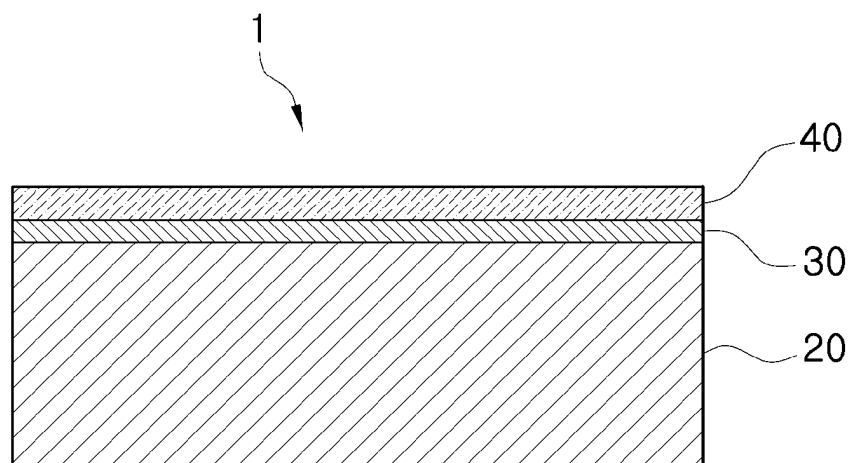
50

55

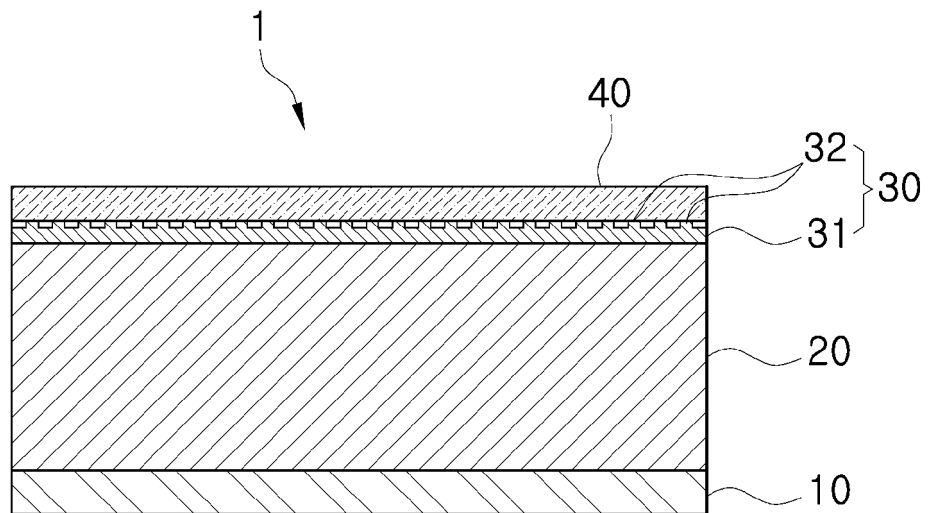
[Fig. 1]



[Fig. 2]



[Fig. 3]



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- KR 1020110123920 [0009]
- KR 101003476 [0010]
- KR 1020110123920 A [0012]