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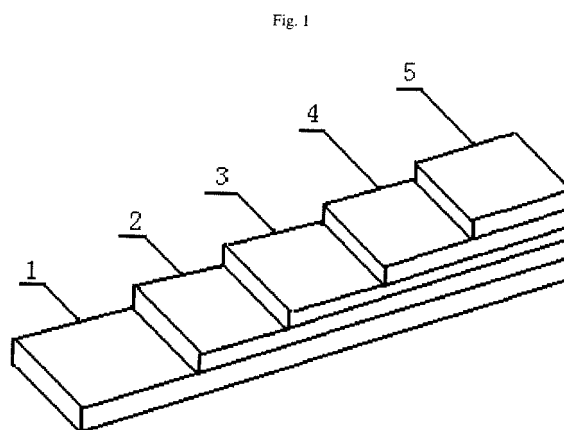
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(54) **ULTRAVIOLET CURING TRANSFER FILM, MANUFACTURING METHOD THEREFOR AND APPLICATION THEREOF**

(57) The present invention pertains to finishing material field, in particular relates to an UV-curing transfer film, and a preparation method and an application of the UV-curing transfer film. Uniformly spread or print release agent on a substrate film, and then cure the release agent under infrared irradiation, to obtain a release agent layer on the substrate film; uniformly spread or print UV-curable ink that has patterns and decorative effect on the release agent layer, and then cure the ink under UV irradiation, to obtain an UV-curable ink decorative pattern layer; or, first, uniformly spread or print a layer of UV-curable protective paint that is scratch and wear resistant, cure the UV-curable protective paint under UV irradiation, and then uniformly spread or print UV-curable ink that has patterns and decorative effect on the UV-curable protective layer, and cure the UV-curable ink under UV irradiation; uniformly spread or print UV-curable background color paint on the UV-curable ink decorative pattern layer, and cure the UV-curable background color paint, so as to obtain an UV-curing transfer film, which can be used to produce UV-curing transfer film decorative boards/plates. The UV-curing transfer film provided in the present invention has advantages such as high material strength, high weather resistance, environmental protection, rich colors and patterns, full and rigid paint film, high

scratch resistance, easy cleaning, and non-flammability, etc.



Description

Field of the Invention

[0001] The present invention pertains to the finishing material field, in particular relates to an UV-curing transfer film or colorful transfer film produced by uniformly spreading or printing UV-curable paint/ink (abbreviated as UV paint/ink), and a preparation method and an application of the UV-curing transfer film or colorful transfer film.

Background of the Invention

[0002] Nowadays, as interior and exterior finishing products become luxury increasingly and the requirements of the state for environmental protection, energy conservation, and sustainable development become higher and higher, the criteria for energy conservation and emission reduction in production and construction procedures become more and more stringent. At present, existing transfer films for interior and exterior finishing products are usually thermal transfer films or aqueous transfer films. However, thermal transfer films or aqueous transfer films involve volatilization of a great deal of organic solvent and heavy exhaust pollution, as described in CN101318420; moreover, when thermal transfer films or aqueous transfer films are applied to timber boards, cement boards, gypsum boards, or metal plates, thermal transfer films or aqueous transfer films tend to peel off from the boards or plates. Photo-cured paint is a sort of green paint free of volatile organic compounds, and UV-curable paint or UV-curable ink has advantages such as high curing rate, low energy consumption, low equipment investment, small equipment footprint, and high film performance, etc.; therefore, the application of UV-curable colorful transfer films can bring more benefits.

Summary of the Invention

[0003] An object of the present invention is to provide an UV-curing transfer film or UV-curable colorful transfer film, which is rich in colors and patterns, and has high decorative and protective performance.

[0004] Another object of the present invention is to provide a method for preparation of UV-curing transfer film or UV-curable colorful transfer film.

[0005] Another object of the present invention is to provide an application of UV-curing transfer film or UV-curable colorful transfer film.

[0006] The UV-curing transfer film or UV-curable colorful transfer film provided in the present invention can comprise a substrate film, a release agent layer, an UV-curable ink decorative pattern layer, and an UV-curable paint background layer, wherein, the release agent layer is on the substrate film, the UV-curable ink decorative pattern layer is on the release agent layer, and the UV-curable paint background layer is on the UV-curable ink

decorative pattern layer; or

[0007] The transfer film can comprise a substrate film, a release agent layer, an UV-curable paint protective layer, an UV-curable ink decorative pattern layer, and an UV-curable paint background layer, wherein, the release agent layer is on the substrate film, the UV-curable paint protective layer on the release agent layer, the UV-curable ink decorative pattern layer is on the UV-curable paint protective layer, and the UV-curable paint background layer is on the UV-curable ink decorative pattern layer.

[0008] The release agent layer can be coated or printed to required thickness, preferably 1~100 μ m thickness.

[0009] The UV-curable paint protective layer can be coated or printed to required thickness, preferably 1~100 μ m thickness.

[0010] The UV-curable ink decorative pattern layer can be coated or printed to required thickness, preferably 1~100 μ m thickness.

[0011] The UV-curable paint background layer can be coated or printed to required thickness, preferably 1~100 μ m thickness.

[0012] Calculated in weight percentage, the release agent that is used to produce the release agent layer is a mixture of 20~50% cellulose, 1~30% wax, 0~10% silicone oil, 0~10% (preferably 10~20%), 0~15% ethyl acetate (preferably 5~15%), 5~20% acrylate prepolymer, 5~20% acrylate monomer, and 1~6% photoinitiator.

[0013] Calculated in weight percentage, the UV-curable paint that is used to produce the UV-curable paint protective layer is:

A. mixture of 10~80% acrylate prepolymer, 5~50% acrylate monomer, 1~6% photoinitiator, 0~2% auxiliary agent, 0~50% filler, 0~10% butanone, and 0~15% ethyl acetate; or

B. mixture of 10~80% acrylate prepolymer, 5~50% acrylate monomer, 1~6% photoinitiator, 0~2% auxiliary agent, 0~50% filler, 1~50% matting agent, 0~10% butanone, and 0~15% ethyl acetate.

[0014] Calculated in weight percentage, the UV-curable ink that is used to produce the UV-curable ink decorative pattern layer is a mixture of 10~60% acrylate prepolymer, 5~50% acrylate monomer, 1~5% photoinitiator, 0~2% auxiliary agent, 0~50% filler, 5~30% toner, 5~30% resin, 0~10% butanone, and 0~15% ethyl acetate.

[0015] Calculated in weight percentage, the UV-curable paint that is used to produce the UV-curable paint background layer is a mixture of 10~50% acrylate prepolymer, 10~40% acrylate monomer, 1~5% photoinitiator, 0~2% auxiliary agent, 0~30% filler, 5~30% toner, 5~50% resin, 0~10% butanone, and 0~15% ethyl acetate.

[0016] The substrate film can be any of polypropylene film, polyethylene film, polyvinyl chloride film, and polyethylene terephthalate film.

[0017] The polypropylene film can be a modified poly-

propylene film.

[0018] The cellulose can be methylol cellulose.

[0019] The wax can be modified paraffin wax, palm wax, or a mixture of them.

[0020] The silicone oil can be selected from at least one compound in the group of methyl-silicone oil, phenyl methyl silicone oil, and hydroxyl silicone oil, etc.

[0021] The acrylate prepolymer can be selected from at least one compound in the group of epoxy acrylate, fluorine-containing epoxy acrylate, polyurethane acrylate, fluorine-containing polyurethane acrylate, polyester acrylate, fluorine-containing polyester acrylate, amino acrylate, fluorine-containing amino acrylate, acrylate copolymer, and fluorine-containing acrylate copolymer, etc.

[0022] The acrylate monomer can be: (1) mono-functional monomer, such as butyl acrylate, cyclohexyl acrylate, ethylhexyl acrylate (EHA), hydroxyethyl acrylate (HEA), hydroxyethyl methacrylate (HEMA), trifluoro ethyl acrylate, trifluoro ethyl methacrylate, hexafluoro butyl acrylate, hexafluoro butyl methacrylate, dodecafluoro heptyl acrylate, or dodecafluoro heptyl methacrylate, etc.; (2) bi-functional monomer, such as tripropylene glycol diacrylate (TPGDA), dipropylene glycol diacrylate (DPGDA), neopentyl glycol diacrylate (NPGDA), propoxy-neopentyl glycol diacrylate (PO-NPGDA), phthalandione di-(diethylene glycol) diacrylate (PDDA), or 1, 6-ethylene glycol diacrylate (HDDA), etc.; (3) poly-functional monomer, such as trimethylolpropane triacrylate (TMPTA), ethoxy-trimethylolpropane triacrylate (EO-TMPTA), propoxy-trimethylolpropane triacrylate (PO-TMPTA), pentaerythritol triacrylate (PETA), or dipentaerythritol hexa-acrylate (DPHA), etc., and is usually selected from at least one compound in any above group of acrylate monomers.

[0023] The resin can be selected from at least one compound in the group of modified polyvinyl acetate, polyamide resin, thermoplastic acrylic, etc.

[0024] The modified polyvinyl acetate can be vinyl chloride vinyl acetate, ethylene vinyl acetate, or a mixture of them.

[0025] The photoinitiator can be selected from at least one compound in the group of benzoin ether photoinitiator, benzil ketal photoinitiator, acetophenone photoinitiator, anthraquinone photoinitiator, thioxanthone photoinitiator, benzophenone photoinitiator, acyl phosphine oxide photoinitiator, and benzoate photoinitiator.

[0026] The benzoin ether photoinitiator can be selected from at least one compound in the group of benzoin methyl ether, benzoin ethyl ether, and benzoin isopropyl ether, etc.

[0027] The benzil ketal photoinitiator can be benzil dimethyl ketal, etc.

[0028] The acetophenone photoinitiator can be selected from at least one compound in the group of acetophenone, 2, 2-dimethoxy-2-phenyl acetophenone, 2, 2-diethoxy-2-phenyl acetophenone, 1, 1-dichloroacetophenone, 1-hydroxyl acetophenone, 1-hydroxyl cyclohexyl phenyl ketone, 2-hydroxyl-2-methyl-1-phenyl-1-ace-

tone, 1-(4-isopropyl phenyl)-2-hydroxyl-2-methyl-1-acetone, 1-[4-(2-hydroxyl ethoxy) phenyl]-2-hydroxyl-2-methyl-1-acetone, 2-methyl-1-[4-(methyl sulfonyl) phenyl]-2-morpholinyl-1-acetone, and 2-benzyl-2-dimethyl amido-1-(4-morpholinyl phenyl)-1-butanone.

[0029] The anthraquinone photoinitiator can be selected from at least one compound in the group of 2-tertiary butyl anthraquinone, 1-chlorine anthraquinone, and 2-amyl anthraquinone.

[0030] The thioxanthone photoinitiator can be selected from at least one compound in the group of 2, 4-dimethyl thioxanthone, 2, 4-diethyl thioxanthone, 2-isopropyl thioxanthone, 4-isopropyl thioxanthone, 2-chloro-thioxanthone, and 2, 4-diisopropyl thioxanthone, etc.

[0031] The benzophenone photoinitiator can be selected from at least one compound in the group of diphenyl ketone, 4-chlorine diphenyl ketone, methyl benzophenone, and 4-benzoyl-4'-methyl diphenyl thioether, etc.

[0032] The acyl phosphine oxide photoinitiator can be selected from at least one compound in the group of 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, di-(2, 4, 6-trimethyl benzoyl)-phenyl phosphine oxide, di-(2, 6-dimethyl benzoyl)-2, 4, 4-trimethyl amyl phosphine oxide, 2, 4, 6-trimethyl benzoyl phenyl ethoxy phosphine oxide, etc.

[0033] The benzoate photoinitiator can be methyl benzoyl benzoate, methyl ortho-benzoyl benzoate, or a mixture of them.

[0034] The auxiliary agent is preferably selected from at least one compound in the group of flattening agent from BKY Additives & Instruments (e.g., BYK306, BYK358, or a mixture of them), anti-foaming agent from BKY Additives & Instruments (e.g., BYK052, BYK055, or a mixture of them), and wetting and dispersing agent from BKY Additives & Instruments (e.g., Disperbyk 103, Disperbyk 163, or a mixture of them).

[0035] The filler can be selected from at least one compound in the group of talcum powder, calcium carbonate, and barium sulfate, etc.

[0036] The toner can be selected from at least one in the group of soot carbon, titanium pigment, titanium cyanine, proflavine, and scarlet powder, etc.

[0037] The matting agent is matting wax (preferably the matting wax from Japan GIFU), matting powder, or a mixture of them.

[0038] The method for preparation of UV-curing transfer film provided in the present invention is: uniformly spread or print release agent on a substrate film, and then cure the release agent under infrared irradiation, to obtain a release agent layer on the substrate film; uniformly spread or print UV-curable protective paint that is scratch-resistant and wear-resistant on the release agent layer, and then cure the paint under UV irradiation, to obtain an UV-curable paint protective layer; uniformly spread or print UV-curable ink that has patterns and decorative effect on the UV-curable paint protective layer, and then cure the ink under UV irradiation, to obtain an

UV-curable ink decorative pattern layer; uniformly spread or print UV-curable background color paint on the UV-curable ink decorative pattern layer, and then cure the paint under UV irradiation, to obtain an UV-curing transfer film finally; or

[0039] Uniformly spread or print release agent on the substrate film, and then cure the release agent under infrared irradiation, to obtain a release agent layer on the substrate film; uniformly spread or print UV-curable ink that has patterns and decorative effect on the release agent layer, and then cure the ink under UV irradiation, to obtain an UV-curable ink decorative pattern layer; uniformly spread or print UV-curable background color paint on the UV-curable ink decorative pattern layer, and then cure the paint under UV irradiation, to obtain an UV-curing transfer film finally.

[0040] The substrate film used in the present invention can be pre-treated, by baking at a temperature within 60–200°C range determined according to the material of the substrate film, to force the substrate film to pre-shrink, and remove electrostatic charges.

[0041] The curing process under infrared irradiation is: adjust the infrared heating temperature to 20–150°C, let the release agent to flow flat for 0.01–10min., and cure the release agent completely.

[0042] The curing process under UV irradiation is: expose the paint/ink to UV irradiation from 1–3 ultraviolet lamps (high-voltage mercury lamps) with 2–20Kw unit power and 0–3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3–20Kw unit power in an UV curing machine, at 200–600nm wavelength, to cure the UV-curable protective paint, UV-curable ink, and UV-curable background color paint, with the UV curing machine operating at 1–200m/min. conveying speed.

[0043] The UV-curing transfer film or UV-curable colorful transfer film provided in the present invention is available in a variety of colors, patterns, and textures, including: colorful transfer film with masonry texture (e.g., artificial marble or granite), colorful transfer film with timber texture, colorful transfer film with brushed metal effect, colorful transfer film with mirror metal effect, colorful transfer film with crystal effect, colorful transfer film with character or cartoon images, colorful transfer film with poetry images, colorful transfer film with plant and animal images, and colorful transfer film with landscape images, etc. The UV-curing transfer film or UV-curable colorful transfer film provided in the present invention can be used as a decorative material for various indoor or outdoor products.

[0044] UV-curing transfer films or UV-curable colorful transfer films obtained with the preparation method provided in the present invention have advantages such as high material strength, high weather resistance, environmental protection, rich colors and patterns, full and rigid paint film, high scratch resistance, easy cleaning, and non-flammability, etc., and have better decorative and protective performance than existing thermal transfer

films and aqueous transfer films.

[0045] The UV-curing transfer film or UV-curable colorful transfer film provided in the present invention can be used to produce UV-curing transfer film decorative boards.

[0046] The application described in the present invention is: apply a layer of UV-curable permeating agent (e.g., the UV-curable permeating agent disclosed in Patent Application No. CN200710120791.1) on the surface of a substrate, such as fiber reinforced cement board, fiber reinforced calcium silicate board, fiber reinforced magnesium oxide board, light-weight magnesium chloride cement board, magnesium oxychloride board, or gypsum board, apply a layer of UV-curable paint filler on the surface of the UV-curable permeating agent, apply a layer of UV-curable sealing prime varnish on the surface of the UV-curable paint filler, apply a layer of UV-curable pigmented paint on the surface of the UV-curable sealing prime varnish, apply a layer of UV-curable glue on the surface of the UV-curable pigmented paint, and transfer a transfer film onto the UV-curable glue (the transfer film can be transferred with a transfer machine onto the surface of a decorative board that is coated with UV-curable glue), to obtain an UV-curing transfer film decorative board; or

[0047] Apply a layer of UV-curable sealing clear prime paint on the surface of a substrate (e.g., solid timber board, medium density fiberboard, or plywood board), apply a layer of UV-curable glue on the surface of the UV-curable sealing clear prime paint, and transfer a transfer film onto the surface of the UV-curable glue (the transfer film can be transferred with a transfer machine to the surface of a decorative board that is coated with UV-curable glue), to obtain an UV-curing transfer film decorative board; or Apply a layer of UV-curable metal prime paint on the surface of a substrate (e.g., aluminum plate, steel plate, or iron plate), apply a layer of UV-curable glue on the surface of the UV-curable metal prime paint, and transfer a transfer film onto the surface of the UV-curable glue (the transfer film can be transferred with a transfer machine to the surface of a decorative plate that is coated with UV-curable glue), to obtain an UV-curing transfer film decorative plate.

[0048] The UV-curing transfer film decorative board/plate is further coated with a layer of UV-curable glue, and then coated with a layer of UV-curable protective varnish on the surface of the UV-curable glue; moreover, a polypropylene or polyethylene protective film can be applied on the surface of the UV-curable protective varnish (if the transfer film itself has a protective layer, the process of applying a layer of UV-curable glue on the surface of the transfer film, applying a layer of UV-curable protective varnish on the surface of the UV-curable glue, and applying a polypropylene or polyethylene protective film on the surface of the UV-curable protective varnish can be omitted). The UV-curable permeating agent can be coated by roller coating or brush painting, at a rate of 50–500g/m², to provide high anchoring, waterproof, and

alkali-resistant effect; after cured, the UV-curable permeating agent is incorporated into the substrate, so as to increase the strength of the substrate, ensure firm bonding between the paint film and the substrate, and thereby ensure the service life of the decorative board/plate.

[0049] The UV-curable paint filler can be coated by roller coating or blade coating, to 10~150 μ m thickness.

[0050] The UV-curable sealing clear prime paint can be coated by roller coating, flow coating, or spray coating, to 10~150 μ m thickness.

[0051] The UV-curable pigmented paint can be coated by roller coating, flow coating, or spray coating, to 10~15 μ m thickness.

[0052] The UV-curable metal prime paint can be coated by roller coating, flow coating, or spray coating, to 2~150 μ m thickness.

[0053] The UV-curable glue can be coated by roller coating or spray coating, to 2~150 μ m thickness.

[0054] The UV-curable protective varnish can be coated by roller coating, flow coating, or spray coating, to 10~250 μ m thickness, at 10~100-degree adjustable glossiness (measured with a 60-degree glossmeter).

[0055] The UV-curing transfer film decorative board/plate in the present invention can be obtained with the following preparation method:

- (1) Surface treatment of the substrate;
- (2) Coat UV-curable permeating agent on the substrate prepared in step (1);
- (3) Let the coating to flow flat under infrared irradiation or naturally;
- (4) Coat UV-curable paint filler on the substrate prepared in step (3);
- (5) Cure under UV irradiation;
- (6) Coat UV-curable sealing clear prime paint on the substrate prepared in step (5);
- (7) Cure under UV irradiation;
- (8) Sanding and dust removing;
- (9) Coat UV-curable sealing clear prime paint on the substrate prepared in step (8);
- (10) Cure under UV irradiation;
- (11) Coat UV-curable pigmented paint on the substrate prepared in step (10);
- (12) Let the coating to flow flat under infrared irradiation or naturally;
- (13) Cure under UV irradiation;
- (14) Sanding and dust removing;
- (15) Coat UV-curable glue on the substrate prepared in step (14);
- (16) Cure under UV irradiation;
- (17) Transfer a transfer film onto the substrate prepared in step (16);
- (18) Cure under UV irradiation;
- (19) Remove the film;
- (20) Let the coating to flow flat under infrared irradiation;
- (21) Coat UV-curable glue on the substrate prepared in step (20);

- (22) Cure under UV irradiation;
- (23) Coat UV-curable protective varnish on the substrate prepared in step (22);
- (24) Let the coating to flow flat under infrared irradiation or naturally;
- (25) Cure under UV irradiation;
- (26) Inspection;
- (27) Apply a protective film;
- (28) Packaging

[0056] The steps 19~27 can be omitted, if the transfer film itself has a protective layer.

Or

- (1) Surface treatment of the substrate;
- (2) Coat UV-curable sealing clear prime paint on the substrate prepared in step (1);
- (3) Cure under UV irradiation;
- (4) Sanding and dust removing;
- (5) Coat UV-curable glue on the substrate prepared in step (4);
- (6) Cure under UV irradiation;
- (7) Transfer a transfer film onto the substrate prepared in step (6);
- (8) Cure under UV irradiation;
- (9) Remove the film;
- (10) Let the coating to flow flat under infrared irradiation;
- (11) Coat UV-curable glue on the substrate prepared in step (10);
- (12) Cure under UV irradiation;
- (13) Coat UV-curable protective varnish on the substrate prepared in step (12);
- (14) Let the coating to flow flat under infrared irradiation or naturally;
- (15) Cure under UV irradiation;
- (16) Inspection;
- (17) Apply a protective film;
- (18) Packaging

[0057] The steps 9~17 can be omitted, if the transfer film itself has a protective layer.

Or

- (1) Surface treatment of the substrate;
- (2) Coat UV-curable metal prime paint on the substrate prepared in step (1);
- (3) Cure under UV irradiation;
- (4) Coat UV-curable glue on the substrate prepared in step (3);
- (5) Cure under UV irradiation;
- (6) Transfer a transfer film onto the substrate prepared in step (5);
- (7) Cure under UV irradiation;
- (8) Remove the film;
- (9) Let the coating to flow flat under infrared irradiation;
- (10) Coat UV-curable glue on the substrate prepared

in step (9);

(11) Cure under UV irradiation;

(12) Coat UV-curable protective varnish on the substrate prepared in step (11);

(13) Let the coating to flow flat under infrared irradiation or naturally;

(14) Cure under UV irradiation;

(15) Inspection;

(16) Apply a protective film;

(17) Packaging

[0058] The steps 8~16 can be omitted, if the transfer film itself has a protective layer.

[0059] Surface treatment of the substrate: treat the substrate by sanding, and remove dust from the surface of the substrate.

[0060] Coat UV-curable permeating agent: coat UV-curable permeating agent by roller coating or brush painting, at a coating rate of 50~500g/m².

[0061] Let the coating to flow flat under infrared irradiation or naturally: adjust the temperature in the infrared flattening machine to 20~150°C, and let the coating to flow flat for 0.1~10min., and let the solvent in the coat to volatilize fully; if natural flattening is used, hold the coated work piece for 1min.~24h under natural conditions, to let the coating to flow flat and the solvent in the coating to volatilize fully.

[0062] Coat UV-curable paint filler: coat UV-curable paint filler by roller coating or blade coating, to 10~150μm thickness.

[0063] Cure under UV irradiation: load the coated work piece into an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power, and cure the coating under UV irradiation, at 200~600nm wavelength, with the UV curing machine operating at 5~50m/min. conveying speed.

[0064] Coat UV-curable sealing clear prime paint: coat UV-curable sealing clear prime paint by roller coating, flow coating, or spray coating, to 10~150μm thickness.

[0065] Sanding and dust removing: treat the work piece in a sanding machine, with an 80~800-mess abrasive belt, and remove the dust from the surface of the work piece. Coat UV-curable sealing clear prime paint: coat UV-curable sealing clear prime paint by roller coating, flow coating, or spray coating, to 5~50μm thickness.

[0066] Coat UV-curable pigmented paint: coat UV-curable sealing clear prime paint by roller coating, flow coating, or spray coating, to 10~150μm thickness.

[0067] Coat UV-curable glue: coat UV-curable sealing clear prime paint by roller coating, flow coating, or spray coating, to 2~150μm thickness.

[0068] Coat UV-curable metal prime paint: coat UV-curable metal prime paint by roller coating, flow coating, or spray coating, to 10~150μm thickness.

[0069] Transfer a transfer film: transfer a transfer film in a transfer machine.

[0070] Remove film: Remove the film with a manual or automatic film peeling machine.

[0071] Coat UV-curable protective varnish: coat UV-curable protective varnish by roller coating, flow coating, or spray coating, to 10~250μm thickness, at 10~100-degree adjustable glossiness (measured with a 60-degree glossmeter).

[0072] The UV-curable permeating agent, UV-curable paint filler, UV-curable sealing clear prime paint, UV-curable pigmented paint, UV-curable glue, UV-curable metal prime paint, and UV-curable protective varnish are paint or glue well known in the art. For example:

[0073] Calculated in weight percentage, the UV-curable permeating agent comprises 10~80% acrylate prepolymer, 10~89 % acrylate monomer, 1~5% photoinitiator, 0~2% auxiliary agent, and 0~50% solvent.

[0074] Calculated in weight percentage, the UV-curable paint filler comprises 10~80% acrylate prepolymer, 5~50 % acrylate monomer, 1~5% photoinitiator, 0~2% auxiliary agent, and 0~50% filler.

[0075] Calculated in weight percentage, the UV-curable sealing clear prime paint comprises 10~80% acrylate prepolymer, 5~60 % acrylate monomer, 1~6% photoinitiator, 0~2% auxiliary agent, and 0~50% filler.

[0076] Calculated in weight percentage, the UV-curable pigmented paint comprises 10~80% acrylate prepolymer, 5~60% acrylate monomer, 1~6% photoinitiator, 0~2% auxiliary agent, 0~50% filler, and 0~50% pigment.

[0077] Calculated in weight percentage, the UV-curable glue comprises 10~80% acrylate prepolymer, 5~60% acrylate monomer, 1~6% photoinitiator, 0~2% auxiliary agent, and 0~50% filler.

[0078] Calculated in weight percentage, the UV-curable metal prime paint comprises 10~80% acrylate prepolymer, 1~80% acrylate monomer, 1~15% photoinitiator, 0~5% auxiliary agent, and 0~30% filler.

[0079] Calculated in weight percentage, the UV-curable metal protective varnish usually comprises 10~80% acrylate prepolymer, 1~80% acrylate monomer, 1~15% photoinitiator, 0~5% auxiliary agent, 0~30% filler, and 0~30% solvent.

[0080] The acrylate prepolymer is the same as the acrylate prepolymer used to prepare the UV-curing transfer film or UV-curable colorful transfer film in the present invention. The photoinitiator is the same as the photoinitiator used to prepare the UV-curing transfer film or UV-curable colorful transfer film in the present invention.

[0081] The auxiliary agent is the same as the auxiliary agent used to prepare the UV-curing transfer film or UV-curable colorful transfer film in the present invention.

[0082] The filler can be any of talcum powder, calcium carbonate, and barium sulfate powder. The solvent is selected from at least one compound in the group of methyl benzene, dimethyl benzene, ethyl acetate, butyl acetate, butanone, cyclohexanone, isopropanol, and ethylene glycol monobutyl ether.

[0083] UV-curing transfer films/UV-curable colorful transfer film decorative boards/plates obtained with the

preparation method provided in the present invention have advantages such as high material strength, high weather resistance, environmental protection, rich colors and patterns, full and rigid paint film, high scratch resistance, fouling resistance and easy cleaning, and non-flammability, etc., and have better decorative and protective performance than existing thermal transfer films and aqueous transfer films.

[0084] The method for production of UV-curing transfer film provided in the present invention have advantages such as small equipment footprint, low equipment investment, high production efficiency, low energy consumption, and free of pollution, etc.; moreover, when the transfer film provided in the present invention is applied to timber boards, cement boards, gypsum boards, or metal plates, the transfer film adheres to the boards/plates firmly, and will not peel off from the boards/plates.

Brief Description of the Drawings

[0085]

Figure 1 is a sectional view of the structure of an UV-curing transfer film provided in the present invention; Figure 2 is a sectional view of the structure of an UV-curing transfer film provided in the present invention.

Brief Description of the Symbols in the Drawings

[0086] 1. substrate film, 2. release agent layer, 3. UV-curable protective layer 4. UV-curable ink decorative pattern layer, 5. UV-curable paint background layer

Detailed Description of the Embodiments

[0087] Embodiment 1: colorful transfer film with Arabescato Coccoha or Black Marquina marble texture

[0088] The structure of a colorful transfer film with Arabescato Coccoha or Black Marquina marble texture is shown in Figure 1. The colorful transfer film comprises a substrate film 1, a release agent layer 2, an UV-curable protective layer 3, an UV-curable ink decorative pattern layer 4, and an UV-curable paint background layer 5. The preparation method comprises the following steps:

- 1) Bake a polypropylene film (substrate film) at 120°C, to force the film to preshrink, and remove electrostatic charges.
- 2) Uniformly spread or print release agent on the surface of the polypropylene film prepared in step 1), and then cure the coating under infrared irradiation, i.e., adjust the infrared heating temperature to 60°C, let the coating to flow flat for 1min., and cure the release agent completely, to obtain a release agent layer in 1 μm thickness.

[0089] Calculated in weight percentage, the release agent is a mixture of 41% methylol cellulose, 20% mod-

ified paraffin wax, 18% butanone, 5% ethyl acetate, 5% fluorine-containing amino acrylate, 10% butyl acrylate, and 1% 2-hydroxyl-2-methyl-1-phenyl-1-acetone.

3) Uniformly coat UV-curable protective paint on the surface of the release agent layer prepared in step 2) by spreading or printing, and then cure the UV-curable protective paint under UV irradiation as follows: convey a single layer of coiled material coated with the UV-curable protective paint through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power at a high speed, to cure the UV-curable protective paint under UV irradiation, and thereby obtain an UV-curable protective layer in 10 μm thickness; the wavelength of the UV light source is 300~400nm, and the conveying speed of the UV curing machine is 1~200m/min.;

[0090] Calculated in weight percentage, the UV-curable paint for the protective layer is:

A. mixture of 20% fluorine-containing epoxy acrylate, 40% fluorine-containing polyurethane acrylate, 16% ethoxy-trimethylolpropane triacrylate (EO-TMPTA), 20% propoxy-trimethylolpropane triacrylate (PO-TMPTA), 3% 1-hydroxyl cyclohexyl phenyl ketone, 0.5% BYK 052, and 0.5% Disperbyk 103;

Or

B. Mixture of 10% fluorine-containing amino acrylate, 10% acrylate copolymer, 50% fluorine-containing acrylate copolymer, 9.5% hydroxyethyl methacrylate (HEMA), 10% trifluoro ethyl acrylate, 5% 1-hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 052, 0.3% Disperbyk 103, and 5% GIFU matting agent (matting wax from Japan GIFU).

4) Uniformly coat black UV-curable ink or white UV-curable ink with patterns and decorative effect on the surface of the UV-curable protective layer prepared in step 3) by spreading or printing, and then cure the UV-curable ink under UV irradiation as follows: convey a single layer of coiled material coated with the black UV-curable ink or white UV-curable ink through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power at a high speed, to cure the black UV-curable ink or white UV-curable ink under UV irradiation, and thereby obtain a black decorative pattern layer in 10 μm thickness or white decorative pattern layer in 10 μm thickness; the wavelength of the UV light source is 365~410nm, and the conveying speed of the UV curing machine is 1~200m/min.;

[0091] Calculated in weight percentage, the black UV-curable ink for decorative pattern layer is a mixture of 18.5% fluorine-containing epoxy acrylate, 25% fluorine-containing polyurethane acrylate, 15% propoxy-neopentyl glycol diacrylate (PO-NPGDA), 15% phthalandione di-(diethylene glycol) diacrylate (PDDA), 3% 1-hydroxyl cyclohexyl phenyl ketone, 3% 2,4-diisopropyl thioxanthone, 0.2% BYK 052, 0.3% Disperbyk 103, 10% soot carbon M-E, and 10% polyamide resin;

[0092] Calculated in weight percentage, the white UV-curable ink for decorative pattern layer is a mixture of 5% amino acrylate, 25% fluorine-containing amino acrylate, 5% acrylate copolymer, 10% tripropylene glycol diacrylate (TPGDA), 9.8% dipropylene glycol diacrylate (DPGDA), 2% 1-hydroxyl cyclohexyl phenyl ketone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide (TPO), 0.1% BYK 052, 0.1% Disperbyk 103, 5% talcum powder, 25% titanium pigment, and 10% polyamide resin.

5) Uniformly coat white UV-curable ink on the surface of the black UV-curable decorative pattern layer or white UV-curable decorative pattern layer, and then cure the coating under UV irradiation as follows: convey a single layer of coil material coated with the white UV-curable ink through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power, to cure the white UV-curable ink under UV irradiation, to obtain a colorful transfer film with Black Marquina marble texture or a colorful transfer film with Arabescato Coccoha marble texture, respectively;

[0093] Calculated in weight percentage, the white UV-curable ink for background layer is:
a mixture of 10% fluorine-containing epoxy acrylate, 25% fluorine-containing amino acrylate, 5% acrylate copolymer, 15% ethoxy- trimethylolpropane triacrylate (EO-TMPTA), 9.8% dipropylene glycol diacrylate, (DPGDA), 3% 1-hydroxyl cyclohexyl phenyl ketone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide (TPO), 0.2% BYK 052, 22% titanium pigment, and 7.2% polyamide resin.

Embodiment 2. Colorful transfer film with Royal Batticino beige or buff texture

[0094] The structure of colorful transfer film with Royal Batticino beige or buff texture is the same as that in embodiment 1. The preparation method comprises the following steps:

- 1) Bake a polyethylene film (substrate film) at 160°C, to force the film to preshrink, and remove electrostatic charges.
- 2) Uniformly spread or print release agent on the

surface of the polyethylene film prepared in step 1), and then cure the coating under infrared irradiation, i.e., adjust the infrared heating temperature to 150°C, let the coating to flow flat for 0.01min., and let the solvent in the coating to volatilize fully; cure the release agent completely, to obtain a release agent layer in 5μm thickness;

[0095] Calculated in weight percentage, the release agent is a mixture of 30% methylol cellulose, 25% palm wax, 15% butanone, 5% ethyl acetate, 11% fluorine-containing polyurethane acrylate, 10% polyester acrylate, and 4% 1-hydroxyl cyclohexyl phenyl ketone.

3) Uniformly coat UV-curable protective paint on the surface of the release agent layer prepared in step 2) by spreading or printing, and then cure the UV-curable protective paint under UV irradiation as follows: convey a single layer of coiled material coated with the UV-curable protective paint through a TV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power at a high speed, to cure the UV-curable protective paint under UV irradiation, and thereby obtain an UV-curable protective layer in 15~m thickness; the wavelength of the UV light source is 250-380nm, and the conveying speed of the UV curing machine is 1-200m/min.;

[0096] Calculated in weight percentage, the UV-curable paint for the protective layer is:

A. mixture of 20% fluorine-containing epoxy acrylate, 40% fluorine-containing polyurethane acrylate, 10% ethoxy- trimethylolpropane triacrylate (EO-TMPTA), 20% propoxy-trimethylolpropane triacrylate (PO-TMPTA), 3% 1-hydroxyl cyclohexyl phenyl ketone, 0.5% BYK 052, 0.5% Disperbyk 103, and 6% butanone;

Or

B. mixture of 14% fluorine-containing amino acrylate, 10% acrylate copolymer, 50% fluorine-containing acrylate copolymer, 9.5% hydroxyethyl methacrylate (HEMA), 10% trifluoro ethyl acrylate, 2% 1-hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 052, 0.3% BYK 358, and 4% GIFU matting agent (matting wax from Japan GIFU).

4) Uniformly coat beige UV-curable ink or buff UV-curable ink with patterns and decorative effect on the surface of the UV-curable protective layer prepared in step 3) by spreading or printing, and then cure the UV-curable ink under UV irradiation as follows: convey a single layer of coiled material coated with the beige UV-curable ink or buff UV-curable ink through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (io-

dine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3–20Kw unit power at a high speed, to cure the beige UV-curable ink or buff UV-curable ink under UV irradiation, and thereby obtain a beige decorative pattern layer in 15 μ m thickness or a buff decorative pattern layer in 18 μ m thickness; the wavelength of the UV light source is 300–420nm, and the conveying speed of the UV curing machine is 1–200m/min.;

[0097] Calculated in weight percentage, the beige UV-curable ink for decorative pattern layer is:

A mixture of 20% fluorine-containing acrylate copolymer, 20% fluorine-containing amino acrylate, 9.3% hydroxyethyl acrylate (HEA), 20% dipentaerythritol hexa-acrylate (DPHA), 2% 1-hydroxyl cyclohexyl phenyl ketone 2%, 3% 2-methyl-1-[4-(methyl sulfenyl)-phenyl]-2-morpholinyl-1-acetone, 0.2% BYK 052, 0.3% Disperbyk 103, 15% proflavin, 0.2% scarlet powder, and 10% vinyl chloride vinyl acetate;

[0098] Calculated in weight percentage, the buff UV-curable ink for decorative pattern layer is: a mixture of 10% fluorine-containing epoxy acrylate, 20% fluorine-containing amino acrylate, 17.4% dipropylene glycol diacrylate (DPGDA), 20% dipentaerythritol hexa-acrylate (DPHA), 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 3% 2-methyl-1-[4-(methyl sulfenyl)-phenyl]-2-morpholinyl-1-acetone, 0.3% BYK 052, 0.3% Disperbyk 103, 2% proflavin, 20% titanium pigment, and 5% vinyl chloride vinyl acetate.

5) Uniformly coat white UV-curable ink on the surface of the beige UV-curable decorative pattern layer or buff UV-curable decorative pattern layer, and then cure the coating under UV irradiation as follows: convey a single layer of coil material coated with the white UV-curable ink through an UV curing machine equipped with 1–3 ultraviolet tubes (high-voltage mercury lamps) with 3–20Kw unit power and 0–3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3–20Kw unit power, to cure the white UV-curable ink under UV irradiation, to obtain a colorful transfer film with Royal Batticino beige marble texture or a colorful transfer film with Royal Batticino buff marble texture, respectively.

[0099] Calculated in weight percentage, the white UV-curable ink for background layer is:

a mixture of 20% fluorine-containing epoxy acrylate, 25% ethoxy- trimethylolpropane triacrylate (EO-TMPTA), 2% 1-hydroxyl cyclohexyl phenyl ketone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 2.9% butanone, 0.1% Disperbyk 103, 20% titanium pigment, and 27% polyamide resin.

Embodiment 3: Colorful transfer film with timber texture

[0100] See Figure 2 for the structure of a colorful trans-

fer film with timber texture. The colorful transfer film comprises a substrate film 1, a release agent layer 2, an UV-curable ink decorative pattern layer 4, and an UV-curable paint background layer 5. The preparation method comprises the following steps:

1) Bake a polyvinyl chloride film (substrate film) at 180°C, to force the film to preshrink, and remove electrostatic charges.

2) Uniformly spread or print release agent on the surface of the polyvinyl chloride film prepared in step 1), and then cure the coating under infrared irradiation, i.e., adjust the infrared heating temperature to 80°C, let the coating to flow flat for 2min., and let the solvent in the coating to volatilize fully; cure the release agent completely, to obtain a release agent layer in 100 μ m thickness;

[0101] Calculated in weight percentage, the release agent is a mixture of 30% methylol cellulose, 5% modified paraffin wax, 15% palm wax, 10% hydroxyl silicone oil, 11% butanone, 5% ethyl acetate, 12% fluorine-containing polyurethane acrylate, 10% trifluoro ethyl methacrylate, 0.5% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, and 1.5% 1-hydroxyl cyclohexyl phenyl ketone.

3) Uniformly coat French gray UV-curable ink with patterns and decorative effect on the surface of the release agent layer prepared in step 2) by spreading or printing to obtain French gray timber grains, or uniformly coat red gray ink with patterns and decorative effect by spreading or coating to obtain red gray timber grains, and then cure the French gray UV-curable ink or red gray UV-curable ink under UV irradiation as follows: convey a single layer of coiled material coated with the French gray UV-curable ink or red gray UV-curable ink through an UV curing machine equipped with 1–3 ultraviolet tubes (high-voltage mercury lamps) with 3–20Kw unit power and 0–3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3–20Kw unit power at a high speed, to cure the French gray UV-curable ink or red gray UV-curable ink under UV irradiation, and thereby obtain a French gray timber grain pattern layer in 10 μ m thickness or a red gray timber grain pattern layer in 10 μ m thickness, respectively; the wavelength of the UV light source is 250–420nm, and the conveying speed of the UV curing machine is 1–200m/min.;

[0102] Calculated in weight percentage, the French gray UV-curable ink for decorative pattern layer is:

a mixture of 23% fluorine-containing polyurethane acrylate, 15% polyester acrylate, 10.4% dipentaerythritol hexa-acrylate (DPHA), 15% 1, 6-ethylene glycol diacrylate (HDDA), 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 0.2% BYK 052, 0.3% Disperbyk 103, 0.1% soot

carbon, 20% titanium pigment, 4% vinyl chloride vinyl acetate, 5% polyamide resin, and 2% butanone.

[0103] Calculated in weight percentage, the red gray UV-curable ink for decorative pattern layer is:

a mixture of 10% fluorine-containing epoxy acrylate, 23% fluorine-containing polyurethane acrylate, 12% dipropylene glycol diacrylate (DPGDA), 2% 1-hydroxyl cyclohexyl phenyl ketone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide 3%, 0.3% BYK 052, 0.1% Disperbyk 103, 1% scarlet powder, 0.1% soot carbon, 21% titanium pigment, 3% calcium carbonate, 10% polyamide resin, 4.5% butanone, and 10% ethyl acetate.

5) Uniformly coat white UV-curable ink on the surface of the French gray timber grain pattern layer or red gray timber grain pattern layer prepared in step 3), and then cure the coating under UV irradiation as follows: convey a single layer of coil material coated with the white UV-curable ink through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power, to cure the white UV-curable ink under UV irradiation, to obtain a colorful transfer film with French gray timber texture or a colorful transfer film with red gray timber texture, respectively.

[0104] Calculated in weight percentage, the white UV-curable ink for background layer is:

a mixture of 10% fluorine-containing epoxy acrylate, 17.5% fluorine-containing amino acrylate, 10% acrylate copolymer, 10% ethoxy- trimethylolpropane triacrylate (EO-TMPTA), 10% dipropylene glycol diacrylate (DPGDA), 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 0.2% BYK 052, 25% titanium pigment, 10% thermoplastic acrylic, and 2.3% ethyl acetate.

[0105] Embodiment 4: Colorful transfer film with red crystal diamond effect The structure of a colorful transfer film with red crystal diamond effect is the same as that in embodiment 1. The preparation method comprises the following steps:

- 1) Bake a polyethylene terephthalate film (substrate film) at 60°C, to force the film to preshrink and remove electrostatic charges.
- 2) Uniformly spread or print release agent on the surface of the polyethylene terephthalate film prepared in step 1), and then cure the coating under infrared irradiation, i.e., adjust the infrared heating temperature to 90°C, let the coating to flow flat for 1min., and let the solvent in the coating to volatilize fully; cure the release agent completely, to obtain a release agent layer in 10μm thickness;

[0106] Calculated in weight percentage, the release

agent is a mixture of 20% methylol cellulose, 10% modified paraffin wax, 9% phenylmethyl silicone oil, 20% butanone, 15% ethyl acetate, 20% fluorine-containing polyester acrylate, 5% PO-NPGDA, 0.5% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, and 0.5% 1-hydroxyl cyclohexyl phenyl ketone.

3) Uniformly coat UV-curable protective paint on the surface of the release agent layer prepared in step 2) by spreading or printing, and then cure the UV-curable protective paint under UV irradiation as follows: convey a single layer of coiled material coated with the UV-curable protective paint through a TV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power at a high speed, to cure the UV-curable protective paint under UV irradiation, and thereby obtain an UV-curable protective layer in 15μm thickness; the wavelength of the UV light source is 285-400nm, and the conveying speed of the UV curing machine is 1~200m/min.;

[0107] Calculated in weight percentage, the UV-curable paint for the protective layer is:

A. mixture of 10% fluorine-containing epoxy acrylate, 34.3% fluorine-containing amino acrylate, 30% hexafluoro butyl methacrylate, 20% dodecafluoro heptyl methacrylate, 3% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 2% 1-hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 052, and 0.5% Disperbyk 103;

Or

B. mixture of 10% fluorine-containing amino acrylate, 50% fluorine-containing acrylate copolymer, 17.8% trifluoro ethyl methacrylate, 10% ethoxy- trimethylolpropane triacrylate (EO-TMPTA), 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 3% 1-hydroxyl cyclohexyl phenyl ketone, 0.1% BYK 052, 0.1% Disperbyk 103, and 7% GIFU matting agent (matting wax from Japan GIFU).

4) Uniformly coat pearlescent UV-curable ink or clear red UV-curable ink with patterns and decorative effect on the surface of the UV-curable protective layer prepared in step 3) by spreading or printing, and then cure the UV-curable ink under UV irradiation as follows: convey a single layer of coiled material coated with the pearlescent UV-curable ink or clear red UV-curable ink through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power at a high speed, to cure the pearlescent UV-curable ink or clear red UV-curable ink under UV irradiation, and thereby obtain a pearlescent ink decorative pattern layer in 20μm thickness or a clear red ink decorative pattern layer in 20μm thickness, respectively; the

wavelength of the UV light source is 300-420nm, and the conveying speed of the UV curing machine is 1~200m/min.;

[0108] Calculated in weight percentage, the pearlescent UV-curable ink for decorative pattern layer is a mixture of 15% fluorine-containing polyurethane acrylate, 15% amino acrylate, 15% hexafluoro butyl acrylate, 20% dodecafluoro heptyl acrylate, 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 2.7% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 0.2% BYK 052, 0.1% Disperbyk 103, 20% pearl essence, and 10% polyamide resin.

[0109] Calculated in weight percentage, the clear red UV-curable ink for decorative pattern layer is a mixture of 12% acrylate copolymer, 12.4% fluorine-containing polyurethane acrylate, 10% polyester acrylate, 10% ethylhexyl acrylate (EHA), 15% ethoxy-trimethylolpropane triacrylate (EO-TMPTA), 10% methacrylic acid, 2% 1-hydroxyl cyclohexyl phenyl ketone 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 0.3% BYK 052, 5% clear iron oxide red, and 20.3% polyamide resin.

5) Uniformly coat white UV-curable ink on the surface of the pearlescent UV-curable decorative pattern layer or clear red UV-curable decorative pattern layer, and then cure the coating under UV irradiation as follows: convey a single layer of coil material coated with the white UV-curable ink through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power, to cure the white UV-curable ink under UV irradiation, to obtain a pearlescent transfer film with red crystal diamond effect or a clear red transfer film with red crystal diamond effect, respectively.

[0110] Calculated in weight percentage, the white UV-curable ink for background layer is:

a mixture of 15% fluorine-containing epoxy acrylate, 32% ethoxy- trimethylolpropane triacrylate (EO-TMPTA), 5% dipropylene glycol diacrylate, 2% 1-hydroxyl cyclohexyl phenyl ketone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 20% titanium pigment, 5% talcum powder, and 18% polyamide resin.

Embodiment 5. Colorful transfer film with poetry images

[0111] The structure of a colorful transfer film with poetry images is the same as that in embodiment 1. The preparation method comprises the following steps:

- 1) Bake a polyvinyl chloride film (substrate film) at 140°C, to force the film to preshrink, and remove electrostatic charges.
- 2) Uniformly spread or print release agent on the surface of the polyvinyl chloride film prepared in step 1), and then cure the coating under infrared irradiation, i.e., adjust the infrared heating temperature to 120°C, let the coating to flow flat for 0.5min., and let the solvent in the coating to volatilize fully; cure the release agent completely, to obtain a release agent layer in 20μm thickness;

tion, i.e., adjust the infrared heating temperature to 120°C, let the coating to flow flat for 0.5min., and let the solvent in the coating to volatilize fully; cure the release agent completely, to obtain a release agent layer in 20μm thickness;

[0112] Calculated in weight percentage, the release agent is a mixture of 33% methylol cellulose, 5% modified paraffin wax, 15% palm wax, 2% methyl-silicone oil, 3% phenylmethyl silicone oil, 20% butanone, 5% ethyl acetate, 5% fluorine-containing amino acrylate, 10% dipropylene glycol diacrylate (DPGDA), and 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone.

3) Uniformly coat UV-curable protective paint on the surface of the release agent layer prepared in step 2) by spreading or printing, and then cure the UV-curable protective paint under UV irradiation as follows: convey a single layer of coiled material coated with the UV-curable protective paint through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power at a high speed, to cure the UV-curable protective paint under UV irradiation, and thereby obtain an UV-curable protective layer in 15μm thickness; the wavelength of the UV light source is 200-380nm, and the conveying speed of the UV curing machine is 1~200m/min.;

[0113] Calculated in weight percentage, the UV-curable paint for the protective layer is:

A. mixture of 30% fluorine-containing polyester acrylate, 30% fluorine-containing polyurethane acrylate, 16% trifluoro ethyl methacrylate, 18.5% propoxy-trimethylolpropane triacrylate (PO-TMPTA), 3% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 0.1% BYK 052, 2% talcum powder, and 0.4% ethyl acetate;

Or

B. mixture of fluorine-containing amino acrylate 20%, 10% polyurethane acrylate, 30% fluorine-containing acrylate copolymer, 14% ethoxy-trimethylolpropane triacrylate (EO-TMPTA), 10% trifluoro ethyl acrylate, 5% 1-hydroxyl cyclohexyl phenyl ketone, 0.4% talcum powder, 0.6% ethyl acetate, and 10% matting powder.

4) Uniformly coat mirror silver UV-curable ink or mirror gold UV-curable ink with patterns and decorative effect on the surface of the UV-curable protective layer prepared in step 3) by spreading or printing, and then cure the UV-curable ink under UV irradiation as follows: convey a single layer of coiled material coated with the mirror silver UV-curable ink or mirror gold UV-curable ink through an UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron

lamps, or dysprosium lamps, etc.) with 3~20Kw unit power at a high speed, to cure the mirror silver UV-curable ink or mirror gold UV-curable ink under UV irradiation, and thereby obtain a mirror silver decorative pattern layer in 25 μ m thickness or a mirror gold decorative pattern layer in 25 μ m thickness, respectively; the wavelength of the UV light source is 250~400nm, and the conveying speed of the UV curing machine is 1~200m/min.;

[0114] Calculated in weight percentage, the mirror silver UV-curable ink for decorative pattern layer is:

a mixture of 14.5% fluorine-containing polyurethane acrylate, 15% fluorine-containing epoxy acrylate, 15% hexafluoro butyl acrylate, 15% hexafluoro butyl methacrylate, 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 3% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 0.2% BYK 052, 0.3% butanone, 15% silver powder, and 20% thermoplastic acrylic.

[0115] Calculated in weight percentage, the mirror gold UV-curable ink for decorative pattern layer is:

a mixture of 15% fluorine-containing acrylate copolymer, 16.1% amino acrylate, 15% dipentaerythritol hexa-acrylate (DPHA), 2% 1-hydroxyl cyclohexyl phenyl ketone, 2% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 0.2% BYK 052, 0.2% Disperbyk 103, 18% gold powder, 10% polyamide resin, and 1.5% thermoplastic acrylic.

5) Uniformly coat black UV-curable ink on the surface of the mirror silver UV-curable decorative pattern layer or mirror gold UV-curable decorative pattern layer, and then cure the coating under UV irradiation as follows: convey a single layer of coil material coated with the black UV-curable ink through a UV curing machine equipped with 1~3 ultraviolet tubes (high-voltage mercury lamps) with 3~20Kw unit power and 0~3 metal halide lamps (iodine gallium lamps, iron lamps, or dysprosium lamps, etc.) with 3~20Kw unit power, to cure the black UV-curable ink under UV irradiation, to obtain a mirror silver colorful transfer film with poetry images or a mirror gold colorful transfer film with poetry images, respectively.

[0116] Calculated in weight percentage, the black UV-curable ink for background layer is:

a mixture of 15% fluorine-containing polyester acrylate, 27.7% fluorine-containing amino acrylate, 7% trifluoro ethyl methacrylate, 20% dipropylene glycol diacrylate (DPGDA), 2% 1-hydroxyl cyclohexyl phenyl ketone, 3% 2, 4-diisopropyl thioxanthone, 0.1% BYK 052, 0.2% Disperbyk 103, 8% soot carbon, 2% talcum powder, and 15% polyamide resin.

Embodiment 6. Decorative board with marble texture

[0117] The substrate of the decorative board is a fiber reinforced cement board, fiber reinforced calcium silicate board, fiber reinforced magnesium oxide board, light-

weight magnesium chloride cement board, magnesium oxychloride board, or gypsum board; first, treat the substrate by sanding and remove dust from the surface; then, brush a layer of UV-curable permeating agent on the surface of the substrate at a 120g/m² coating rate, and then hold for 30min. to let the coating to flow flat naturally; next, coat a layer of UV-curable paint filler in thickness of 20 μ m by roller coating; load the coated substrate into an UV curing machine that is equipped with a 9.6Kw UV lamp (high-voltage mercury lamp) and operates at 15m/min. conveying speed to cure the coating; then, coat a layer of UV-curable sealing clear prime paint in thickness of 40 μ m on the surface of the UV-curable paint filler; load the coated board into an UV curing machine that is equipped with two 13Kw UV lamps (high-voltage mercury lamps) and operates at 15m/min. conveying speed to cure the coating; next, treat the board by sanding on a sanding machine, with a 240-mesh abrasive belt, and remove dust from the surface of the board; then, coat a layer of UV-curable sealing clear prime paint in thickness of 10 μ m on the surface of the existing UV-curable sealing clear prime paint by roller coating; load the coated board into an UV curing machine that is equipped with a 9.6KW UV lamp (high-voltage mercury lamp) and operates at 15m/min. conveying speed to cure the coating; next, coat a layer of white UV-curable prime paint in thickness of 10 μ m on the surface of the UV-curable sealing clear prime paint; load the coated board into an UV curing machine that is equipped with five 16.8Kw UV lamps (metal halide lamps) and operates at 15m/min. conveying speed to cure the coating; then, treat the board by sanding on a sanding machine, with a 400-mesh abrasive belt; next, coat a layer of UV-curable glue in thickness of 10 μ m on the surface of the white UV-curable prime paint, and then transfer a colorful transfer film with Black Marquina marble texture or a colorful transfer film with Arabescato Cocoha marble texture as described in embodiment 1 onto the surface of the UV-curable glue; load the coated board into an UV curing machine that is equipped with six 16.8Kw UV lamps (metal halide lamps) and operates at 15m/min. conveying speed to cure the coating; then, remove the film, and let the coating to flow flat for 2min. under infrared irradiation at 90°C temperature; next, load the coated board into an UV curing machine that is equipped with three 13Kw UV lamps (high-voltage mercury lamps) and operates at 15m/min. conveying speed to cure the coating; next, after the treated board is inspected as acceptable, apply a polypropylene protective film on the surface of the board, to obtain a finished decorative board with marble texture finally.

[0118] Calculated in weight percentage, the UV-curable permeating agent comprise: 20% epoxy acrylate, 50% TMPTA, 10% TPGDA, 4% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, and 16% ethyl acetate.

[0119] Calculated in weight percentage, the UV-curable paint filler comprises: 40% epoxy acrylate, 20% polyester acrylate, 16% TMPTA, 20% talcum powder, 3.5% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 0.2% BYK

052, and 0.3% Disperbyk 163.

[0120] Calculated in weight percentage, the UV-curable sealing clear prime paint comprises: 20% fluorine-containing epoxy acrylate, 30% polyurethane acrylate, 10% TPGDA, 20% EO-TMPTA, 15% talcum powder, 4.5% hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 055, and 0.3% Disperbyk 103.

[0121] Calculated in weight percentage, the UV-curable white prime paint comprises: 20% epoxy acrylate, 30% fluorine-containing polyester acrylate, 20% PETA, 10% PO-NPGDA, 15% titanium pigment, 2% 1-hydroxyl cyclohexyl phenyl ketone, 2.5% 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, 0.2% BYK 052, and 0.3% Disperbyk 103.

[0122] Calculated in weight percentage, the UV-curable glue comprises: 35% polyurethane acrylate, 30% fluorine-containing polyester acrylate, 20% PETA, 10% PO-NPGDA, 2.5% 1-hydroxyl cyclohexyl phenyl ketone, 2% 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 0.2% BYK 052, and 0.3% Disperbyk 103.

Embodiment 7: Decorative board with timber texture

[0123] The substrate of the decorative board is a solid timber board, MDF board, or plywood board; first, treat the substrate by sanding and remove dust from the surface; then, coat a layer of UV-curable sealing prime paint in thickness of 40 μ m on the surface of the substrate; load the coated board into an HV curing machine that is equipped with two 9.6Kw UV lamps (high-voltage mercury lamps) and operates at 8m/min. conveying speed to cure the coating; then, treat the board by sanding and remove dust from the surface, and coat a layer of UV-curable glue in thickness of 10 μ m on the surface of the UV-curable sealing prime paint; next, cure the UV-curable glue, and then transfer a colorful transfer film with timber texture (French gray grains) and a colorful transfer film with timber texture (red gray longitudinal grains) as described in embodiment 3; load the transfer film with timber texture into an UV curing machine that is equipped with three 16.8Kw UV lamps (metal halide lamps) and operates at 8m/min. conveying speed to cure the coating; next, remove the film, and let the coating to flow flat for 2min. under infrared irradiation at 90°C temperature; next, coat a layer of UV-curable in thickness of 10 μ m on the surface of the transfer film, cure the glue, and then coat a layer of UV-curable protective semi-matt varnish in thickness of 20 μ m at 60-degree glossiness (measured with a 60-degree glossmeter) by roller coating; let the coating to flow flat for 1min. under infrared irradiation at 50°C temperature; load the coated board into an UV curing machine that is equipped with three 16.8KW UV lamps (metal halide lamps) and operates at 8m/min. conveying speed to cure the coating; after the decorative board is inspected as acceptable, apply a polypropylene protective film on the surface, to obtain a finished decorative board with timber texture finally.

[0124] Calculated in weight percentage, the UV-cura-

ble sealing prime paint comprises: 10% epoxy acrylate, 40% polyurethane acrylate, 20% EO-TMPTA, 10% PO-NPGDA, 15% talcum powder, 4.5% 1-hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 052, and 0.3% Disperbyk 103.

[0125] Calculated in weight percentage, the UV-curable glue comprises: 35% polyurethane acrylate, 30% fluorine-containing polyester acrylate, 20% PETA, 10% PO-NPGDA, 4.5% 1-hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 052, and 0.3% Disperbyk 103. Calculated in weight percentage, the UV-curable semi-matt protective varnish comprises: 30% polyurethane acrylate, 30% fluorine-containing polyurethane acrylate, 10% acrylate copolymer, 10% TMPTA, 10% PETA, 4% 1-hydroxyl cyclohexyl phenyl ketone, 5% matting powder, 0.2% BYK 055, 0.3% BYK 306, and 0.5% Disperbyk 103.

Embodiment 8. Decorative plate with red crystal diamond effect

[0126] The substrate of the decorative plate is an aluminum plate, steel plate, or iron plate; first, clean up the substrate, remove oil stains, foreign matters, and dust from the surface of the substrate; then, coat a layer of UV-curable metal prime paint in thickness of 10 μ m on the surface of the substrate by roller coating; load the coated substrate into an UV curing machine that is equipped with three 13Kw UV lamps (high-voltage mercury lamps) and operates at 10m/min. conveying speed to cure the paint; next, coat a layer of UV-curable glue in thickness of 10 μ m on the surface of the UV-curable metal prime paint, cure the glue, and then transfer a colorful transfer film with red crystal diamond effect as described in embodiment 4 onto the surface of the UV-curable glue; load the plate into an UV curing machine that is equipped with three 16.8Kw UV lamps (metal halide lamps) and operates at 10m/min. conveying speed to cure the coating; remove the film, and let the coating to flow flat for 2min. under infrared irradiation at 90°C temperature; next, load the plate into an UV curing machine that is equipped with four 16.8KW UV lamps (metal halide lamps) and operates at 10m/min. conveying speed to cure the coating completely; after the plate is inspected as acceptable, apply a polypropylene protective film on the surface, to obtain a finished product decorative plate with red crystal diamond effect finally.

[0127] Calculated in weight percentage, the UV-curable metal prime paint comprises: 15% epoxy acrylate, 35% polyurethane acrylate, 20% TMPTA, 10% PO-NPGDA, 15% talcum powder, 4.5% 1-hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 052, and 0.3% Disperbyk 103.

[0128] Calculated in weight percentage, the UV-curable glue comprises: 35% polyurethane acrylate, 30% fluorine-containing polyester acrylate, 20% PETA, 10% PO-NPGDA, 4.5% 1-hydroxyl cyclohexyl phenyl ketone, 0.2% BYK 052, and 0.3% Disperbyk 103.

Claims

1. A UV-curing transfer film, wherein the transfer film comprises a substrate film, a release agent layer, a UV-curing ink decorative pattern layer, and a UV-curing paint background layer, the release agent layer being on the substrate film, the UV-curing ink decorative pattern layer being on the release agent layer, and the UV-curing paint background layer being on the UV-curing ink decorative pattern layer; or the transfer film comprises a substrate film, a release agent layer, a UV-curing paint protective layer, a UV-curing ink decorative pattern layer, and a UV-curing paint background layer, the release agent layer being on the substrate film, the UV-curing paint protective layer being on the release agent layer, the UV-curing ink decorative pattern layer being on the UV-curing paint protective layer, and the UV-curing paint background layer is on the UV-curing ink decorative pattern layer.

2. The UV-curing transfer film according to claim 1, wherein:

the release agent layer is formed by a release agent which is a mixture of 20~50wt% cellulose, 1~30wt% wax, 0~10wt% silicone oil, 0~20wt% butanone, 0~15wt% ethyl acetate, 5~20wt% acrylate prepolymer, 5~20wt% acrylate monomer, and 1~6wt% photoinitiator.

3. The UV-curing transfer film according to claim 1, wherein:

the UV-curing paint protective layer is formed by a UV-curable paint which is a mixture of 10~80wt% acrylate prepolymer, 5~50wt% acrylate monomer, 1~6wt% photoinitiator, 0~2wt% auxiliary agent, 0~50wt% filler, 0~10wt% butanone, and 0~15wt% ethyl acetate; or a mixture of 10~80wt% acrylate prepolymer, 5~50wt% acrylate monomer, 1~6wt% photoinitiator, 0~2wt% auxiliary agent, 0~50wt% filler, 1~50wt% matting agent, 0~10wt% butanone, and 0~15wt% ethyl acetate.

4. The UV-curing transfer film according to claim 1, wherein:

the UV-curing ink decorative pattern layer is formed by a UV-curable ink which is a mixture of 10~60wt% acrylate prepolymer, 5~50wt% acrylate monomer, 1~5wt% photoinitiator, 0~2wt% auxiliary agent, 0~50wt% filler, 5~30wt% toner, 5~30wt% resin, 0~10wt% butanone, and 0~15wt% ethyl acetate.

5. The UV-curing transfer film according to claim 1,

wherein:

the UV-curing paint background layer is formed by a UV-curable paint which is a mixture of 10~50wt% acrylate prepolymer, 10~40wt% acrylate monomer, 1~5wt% photoinitiator, 0~2wt% auxiliary agent, 0~30wt% filler, 5~30wt% toner, 5~50wt% resin, 0~10wt% butanone, and 0~15wt% ethyl acetate.

6. The UV-curing transfer film according to claim 1, wherein, the substrate film is any of polypropylene film, polyethylene film, polyvinyl chloride film, and polyethylene terephthalate film.

7. The UV-curing transfer film according to claim 6, wherein, the polypropylene film is a modified polypropylene film.

8. The UV-curing transfer film according to claim 2, wherein, the cellulose is methylol cellulose; the wax is modified paraffin wax, palm wax, a mixture of them; the silicone oil is at least one selected from methylsilicone oil, benzyl silicone oil, and hydroxyl silicone oil.

9. The UV-curing transfer film according to claim 2, 3, 4, or 5, wherein, the acrylate prepolymer is at least one selected from epoxy acrylate, fluorine-containing epoxy acrylate, polyurethane acrylate, fluorine-containing polyurethane acrylate, polyester acrylate, fluorine-containing polyester acrylate, amino acrylate, fluorine-containing amino acrylate, acrylate copolymer, and fluorine-containing acrylate copolymer;

the acrylate monomer is at least one selected from butyl acrylate, cyclohexyl acrylate, ethylhexyl acrylate, hydroxyethyl acrylate, hydroxyethyl methacrylate, trifluoro ethyl acrylate, trifluoro ethyl methacrylate, hexafluoro butyl acrylate, hexafluoro butyl methacrylate, dodecafluoro heptyl acrylate, dodecafluoro heptyl methacrylate, tripropylene glycol diacrylate, dipropylene glycol diacrylate, neopentyl glycol diacrylate, propoxy-neopentyl glycol diacrylate, phthalandione di-(diethylene glycol) diacrylate, 1,6-hexylene glycol diacrylate, trimethylolpropane triacrylate, ethoxy-trimethylolpropane triacrylate, propoxy-trimethylolpropane triacrylate, pentaerythritol triacrylate, and dipentaerythritol hexaacrylate;

the photoinitiator is at least one selected from benzoin ether photoinitiator, benzil ketal photoinitiator, acetophenone photoinitiator, anthraquinone photoinitiator, thioxanthone photoinitiator, benzophenone photoinitiator, acyl phosphine oxide photoinitiator, and benzoate photoinitiator.

10. The UV-curing transfer film according to claim 4 or 5, wherein, the resin is at least one selected from modified polyvinyl acetate, polyamide resin, and thermoplastic acrylic; the toner is at least one selected from soot carbon, titanium pigment, phthalocyanine blue, proflavine, and scarlet powder.
11. The UV-curing transfer film according to claim 10, wherein, the modified polyvinyl acetate is vinyl chloride vinyl acetate, ethylene vinyl acetate, or a mixture of them.
12. The UV-curing transfer film according to claim 3, 4, or 5, wherein, the auxiliary agent is at least one selected from leveling agent, anti-foaming agent, and wetting and dispersing agent; the filler is at least one selected from talcum powder, calcium carbonate, and barium sulfate.
13. The UV-curing transfer film according to claim 3, wherein, the matting agent is matting wax, matting powder, or a mixture of them.
14. The UV-curing transfer film according to claim 9, wherein, the benzoin ether photoinitiator is at least one selected from benzoin methyl ether, benzoin ethyl ether, and benzoin isopropyl ether; the benzil ketal photoinitiator is benzil dimethyl ketal; the acetophenone photoinitiator is at least one selected from acetophenone, 2,2-dimethoxy-2-phenyl acetophenone, 2,2-diethoxy-2-phenyl acetophenone, 1,1-dichloroacetophenone, 1-hydroxyl acetophenone, 1-hydroxyl cyclohexyl phenyl ketone, 2-hydroxyl-2-methyl-1-phenyl-1-acetone, 1-(4-isopropyl phenyl)-2-hydroxyl-2-methyl-1-acetone, 1-[4-(2-hydroxyl ethoxyl) phenyl]-2-hydroxyl-2-methyl-1-acetone, 2-methyl-1-[4-(methyl sulfenyl) phenyl]-2-morpholinyl-1-acetone, and 2-benzyl-2-dimethyl amido-1-(4-morpholinyl phenyl)-1-butanone; the anthraquinone photoinitiator is at least one selected from 2-tertiary butyl anthraquinone, 1-chlorine anthraquinone, and 2-amyl anthraquinone; the thioxanthone photoinitiator is at least one selected from 2, 4-dimethyl thioxanthone, 2, 4-diethyl thioxanthone, 2-isopropyl thioxanthone, 4-isopropyl thioxanthone, 2-chloro-thioxanthone, and 2, 4-diisopropyl thioxanthone; the benzophenone photoinitiator is at least one selected from diphenyl ketone, 4-chlorine diphenyl ketone, methyl benzophenone, and 4-benzoyl-4'-methyl diphenyl thioether; the acyl phosphine oxide photoinitiator is at least one selected from 2, 4, 6-trimethyl benzoyl diphenyl phosphine oxide, di-(2, 4, 6-trimethyl benzoyl)-phenyl phosphine oxide, di-(2, 6-dimethyl benzoyl)-2, 4, 4-trimethyl amyl phosphine oxide, and 2, 4, 6-trimethyl benzoyl phenyl ethoxyl phosphine oxide;

the benzoate photoinitiator is methyl benzoylbenzoate, methyl ortho-benzoylbenzoate, or a mixture of them.

15. A method for preparation of the UV-curing transfer film according to any of claims 1-14, including: uniformly coating or printing a release agent on a substrate film, and then curing the release agent by infrared irradiation, to obtain a release agent layer on the substrate film; uniformly coating or printing UV-curable protective paint on the release agent layer, and then curing the paint by UV irradiation, to obtain a UV-curing paint protective layer; uniformly coating or printing UV-curable ink that has patterns and decorative effect on the UV-curing paint protective layer, and then curing the ink by UV irradiation, to obtain an UV-curing ink decorative pattern layer; and uniformly coating or printing UV-curable background paint on the UV-curing ink decorative pattern layer, and then curing the paint by UV irradiation, to obtain the UV-curing transfer film; or uniformly coating or printing a release agent on the substrate film, and then curing the release agent by infrared irradiation, to obtain a release agent layer on the substrate film; uniformly coating or printing UV-curable ink that has patterns and decorative effect on the release agent layer, and then curing the ink by UV irradiation, to obtain an UV-curing ink decorative pattern layer; and uniformly coating or printing UV-curable background paint on the UV-curing ink decorative pattern layer, and then curing the paint by UV irradiation, to obtain an UV-curing transfer film.
16. The method according to claim 15, wherein, the curing process under infrared irradiation comprises: adjusting the infrared heating temperature to 20~150°C, allowing the release agent to flow flat for 0.01~10min., and curing the release agent; the curing process under UV irradiation comprises: exposure to UV irradiation in an UV curing machine equipped with 1~3 ultraviolet lamps (high-voltage mercury lamps) with 2~20Kw unit power and 0~3 metal halide lamps with 3~20Kw unit power, at 200~600nm wavelength, to cure the UV-curable protective paint, UV-curable ink, and UV-curable background paint, with the UV curing machine being operated at a conveying speed of 1~200m/min.
17. Use of the UV-curing transfer film according to any of claims 1-14 in the manufacture of an UV-curing transfer film decorative board.
18. The use according to claim 17, comprising: applying a layer of UV-curable permeating agent on the surface of a fiber reinforced cement board, fiber reinforced calcium silicate board, fiber reinforced magnesium oxide board, light-weight magnesium chlo-

ride cement board, magnesium oxychloride board,
 or gypsum board, applying a layer of UV-curable
 paint filler on the surface of the UV-curable perme-
 ating agent, applying a layer of UV-curable sealing
 primer on the surface of the UV-curable paint filler, 5
 applying a layer of UV-curable pigmented paint on
 the surface of the UV-curable sealing primer, apply-
 ing a layer of UV-curable glue on the surface of the
 UV-curable pigmented paint, and transferring the
 transfer film onto the UV-curable glue, to obtain the 10
 UV-curing transfer film decorative board; or
 applying a layer of UV-curable sealing primer on the
 surface of a solid timber board, MDF board, or ply-
 wood board, applying a layer of UV-curable glue on
 the surface of the UV-curable sealing primer, and 15
 transferring the transfer film onto the surface of the
 UV-curable glue, to obtain the UV-curing transfer film
 decorative board; or
 applying a layer of UV-curable metal primer on the
 surface of an aluminum plate, steel plate, or iron 20
 plate, applying a layer of UV-curable glue on the sur-
 face of the UV-curable metal primer, and transferring
 the transfer film onto the surface of the UV-curable
 glue, to obtain the UV-curing transfer film decorative
 plate. 25

19. The use according to claim 18, further comprising
 applying a layer of UV-curable glue on the surface
 of the obtained UV-curing transfer film decorative
 board, and applying a layer of UV-curable protective 30
 varnish on the surface of the UV-curable glue.

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Fig. 1

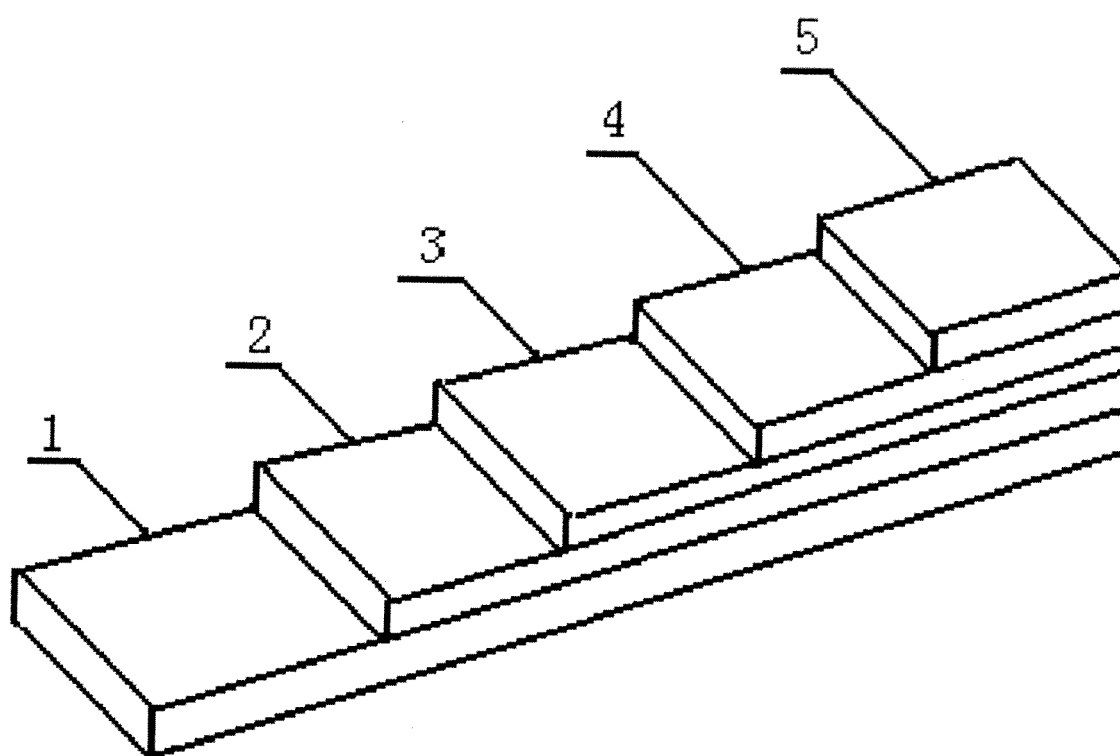
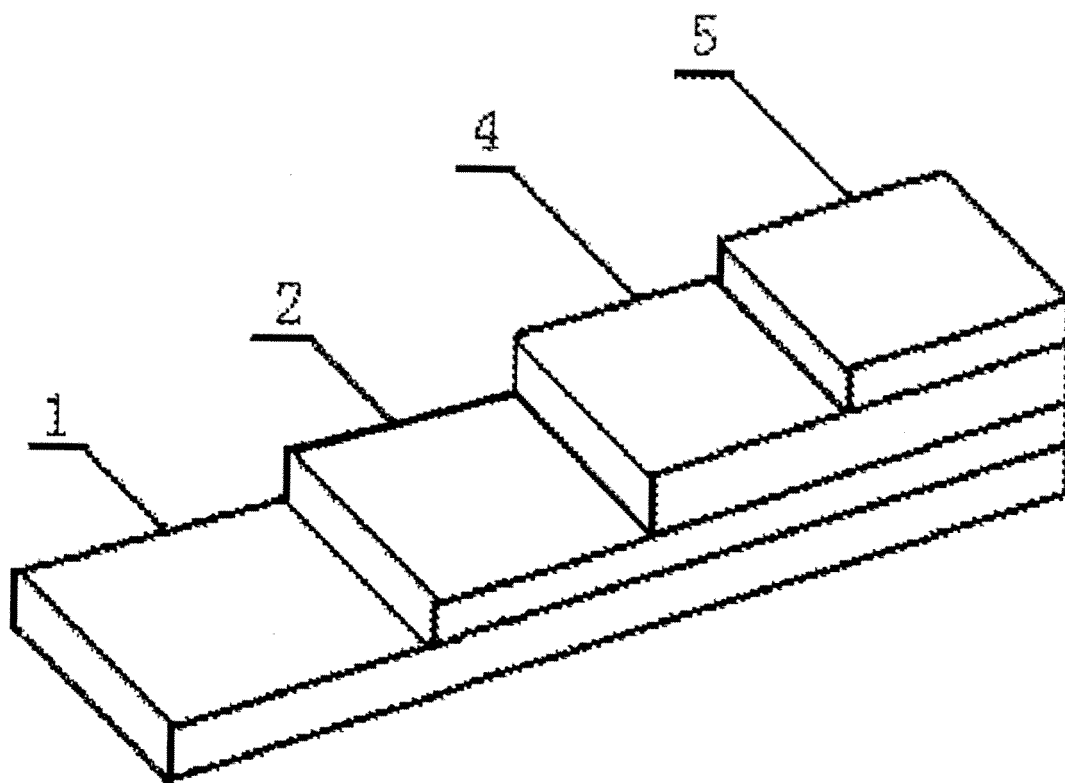


Fig. 2



INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/074567

A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B41M3/12, B41M5/025, B41M5/382, B41M5/40, B41M5/00, B44C1/16, B44C1/165, B44C1/17, C09D, B32B7/00

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

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

WPI, EPODOC, CNPAT, CNKI transfer+, film?, UV, ultraviolet, cure, curing, solidi+, ink, releas+, peel+, coat+, wax, photoinitiator

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Y		17-19
A		2-5
X	JP 9-78473 A (TOKAI MASAHIRO) 25 Mar. 1997 (25.03.1997) see paragraphs [0010]-[0017]	1,15
Y		17-19
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☒ Further documents are listed in the continuation of Box C.☒ See patent family annex.

* Special categories of cited documents:	"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
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"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim (S) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search
18 Mar. 2010 (18.03.2010)Date of mailing of the international search report
08 Apr. 2010 (08.04.2010)Name and mailing address of the ISA/CN
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INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/074567

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A		2,4,15,17
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Form PCT/ISA /210 (continuation of second sheet) (July 2009)

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/CN2009/074567

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Form PCT/ISA /210 (patent family annex) (July 2009)

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2009/074567

CLASSIFICATION OF SUBJECT MATTER

B41M5/40 (2006.01) i

B44C1/16 (2006.01) i

REFERENCES CITED IN THE DESCRIPTION

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