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(54) Title: MULTI-LAYER COATED PRODUCT AND PREPARATION METHOD THEREOF

(57) Abstract: Disclosed herein is a multi-layer coated product comprising a substrate, and a multi-layer coating including an undercoat and a topcoat which are formed on the substrate in sequence, have alcohol resistance, and are in a different color from each other, wherein the multi-layer coating further includes an intermediate coat having no alcohol resistance between the undercoat and the topcoat. Also disclosed herein is a method for preparing the multi-layer coated product. Since the intermediate coat of the multi-layer coated product has no alcohol resistance, when the intermediate coat and topcoat on the backlight part is removed by the laser engraving, it is sufficient that the laser intensity is controlled to be higher than the laser intensity required for completely removing the topcoat and lower than the laser intensity that affects the undercoat, the time required for determining the laser intensity and scrubbing can be shortened, and thereby the production efficiency of said multi-layer coated product can be improved.

Multi-Layer Coated Product and Preparation Method Thereof

Field of the Invention

The present invention relates to a multi-layer coated product and a preparation method thereof.

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Background of the Invention

Presently, with the development of electronic products, increasingly more attention is paid to keys or keyboards which are functional components of the electronic products. The keys or keyboards of electronic products such as a mobile telephone, an electronic dictionary, or a personal digital assistant (PDA), are usually prepared by coating plastics as a substrate with two layers of coating (i.e., an undercoat and a topcoat), to obtain multi-layer coated products; and then, removing the topcoat on the backlight part of the key or the keyboard (i.e., the part with letter or pattern), to expose the undercoat on the part, so that the undercoat shows backlight color, while the topcoat shows the shell color.

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The topcoat on the backlight part is usually removed by laser engraving, at an appropriate laser intensity to ensure that the topcoat is completely removed but the undercoat is not affected. Accordingly, it takes a long testing time to determine the appropriate laser intensity. Furthermore, since the topcoat on different parts of the same key or keyboard may have a different thickness, above requirement may not be met with the same laser intensity, and as a result, the production efficiency will be lowered.

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Moreover, in order to prevent the undercoat from being affected during the laser engraving, the laser intensity used in the laser engraving is usually slightly lower than those required for completely removing the topcoat, such that residual topcoat may remain on the backlight part after the laser engraving, and has to be removed by scrubbing with alcohol. In order to prevent the undercoat and the topcoat on other parts from being scrubbed off by alcohol, the undercoat and topcoat both have the alcohol resistance; therefore, it takes a long time to scrub off the residual topcoat on the backlight part with alcohol, and as a result, the production efficiency is lowered.

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As described above, the multi-layer coated products of the prior art have the drawback of low production efficiency.

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Summary of the Invention

The object of the present invention is to provide a multi-layer coated product featured with high production efficiency and the preparation method thereof, so as to overcome the drawback of low production efficiency of the prior art multi-layer coated products.

5 The present invention provides a multi-layer coated product, comprising:

a substrate, and

a multi-layer coating including an undercoat and a topcoat which are formed on the substrate in sequence, have alcohol resistance, and are in a different color from each other, wherein the multi-layer coating further includes an intermediate coat having no alcohol resistance between
10 the undercoat and the topcoat.

The present invention also provides a preparation method for the multi-layer coated product, including the step of forming an undercoat and a topcoat which have alcohol resistance and are in a different color from each other on a substrate in sequence, wherein it further includes the step of forming an intermediate coat having no alcohol resistance between the undercoat and
15 the topcoat.

The multi-layer coated product provided by the present invention comprises a substrate and a multi-layer coating comprising an undercoat, an intermediate coat, and a topcoat formed on the substrate in sequence, wherein the undercoat and the topcoat both have the alcohol resistance, while the intermediate coat has no alcohol resistance. When the intermediate coat and topcoat
20 on the backlight part are removed by the laser engraving, it is sufficient that the laser intensity is controlled to be higher than the laser intensity required for completely removing the topcoat and lower than the laser intensity that affects the undercoat. Even if the laser intensity is lower than the laser intensity required for completely removing the intermediate coat and the topcoat, the residual intermediate coat having no alcohol resistance on the backlight part can be
25 removed easily with alcohol or alcoholic solution, while the topcoat and undercoat having alcohol resistance will not be scrubbed off by the alcohol or alcoholic solution. Therefore, the time required for determining the laser intensity and scrubbing can be shortened, and thereby the production efficiency of said multi-layer coated product can be improved.

30 Detailed Description of the Embodiments

The multi-layer coated product provided by the present invention comprises:

a substrate, and

a multi-layer coating including an undercoat and a topcoat which are formed on the substrate in

sequence, have alcohol resistance, and are in a different color from each other, wherein the multi-layer coating further includes an intermediate coat having no alcohol resistance between the undercoat and the topcoat.

Said undercoat and topcoat can be the same with the undercoat and topcoat on the keys or
5 keyboards of electronic products in the prior art.

Said undercoat, topcoat, and intermediate coat can each independently have a thickness of 3 to 15 μm , preferably 5 to 9 μm .

Said undercoat and topcoat can independently comprise a film-forming material, chloride-vinyl acetate resin, and a coloring agent, and optional one or more of an adjusting agent and
10 conventional auxiliary agent such as leveling agent and anti-settling agent, etc.. In the undercoat or the topcoat, relative to 100 parts by weight of the film-forming material, the content of said chloride-vinyl acetate resin can be 2 to 50 parts by weight, preferably 5 to 40 parts by weight, and more preferably 10 to 30 parts by weight; the content of said coloring agent can be 3 to 80 parts by weight, preferably 10 to 70 parts by weight, and more preferably
15 20 to 60 parts by weight; the content of said adjusting agent can be 0 to 20 parts by weight, preferably 2 to 15 parts by weight, and more preferably 5 to 12 parts by weight; and the content of said auxiliary agent can be 0 to 20 parts by weight, preferably 2 to 15 parts by weight, and more preferably 5 to 12 parts by weight.

Said intermediate coat can comprise film-forming material, and optional one or more of a
20 coloring agent, an adjusting agent, and conventional auxiliary agent such as leveling agent and anti-settling agent, etc. In the intermediate coat, relative to 100 parts by weight of the film-forming material, the content of said coloring agent can be 0 to 80 parts by weight, preferably 10 to 70 parts by weight, and more preferably 20 to 60 parts by weight; the content of said adjusting agent can be 0 to 20 parts by weight, preferably 2 to 15 parts by weight, and
25 more preferably 5 to 12 parts by weight; and the content of said auxiliary agent can be 0 to 20 parts by weight, preferably 2 to 15 parts by weight, and more preferably 5 to 12 parts by weight.

Said film-forming material can be any conventional film-forming material used in the prior art coated products; for example, the film-forming material contained in the undercoat, the
30 intermediate coat, and the topcoat may be each independently one or more selected from a thermoplastic acrylate resin, a hydroxy acrylic resin, a self-curing alkyd resin, and an aldehyde ketone resin, and among them the thermoplastic acrylate resin is preferred. Said thermoplastic acrylate resin has been well known to those skilled in the art, and is

commercially available or prepared through the copolymerization of acrylate, methacrylate, and other olefin monomers by a known method. For example, said thermoplastic acrylate resin can include, but not limited to ICI2103, ICI2106, Rohm&Haas A-11, Rohm&Haas A-12, Rohm&Haas B60, Rohm&Haas B66, Rohm&Haas A-21, Mitsubishi BR-113, Mitsubishi
5 BR-116, Mitsubishi MB-2952, Mitsubishi MB2660, Mitsui 101, and Mitsui 102, etc. Above trade names are well known to those skilled in the art.

The chloride-vinyl acetate resin contained in said undercoat and said topcoat can be each independently one or more selected from vinyl chloride-vinyl acetate, vinyl chloride-vinyl acetate-hydroxy acrylate, vinyl chloride-vinyl acetate-maleate, and vinyl chloride-vinyl
10 acetate-vinyl alcohol ester. Based on its total weight, the chloride-vinyl acetate resin contains 50 to 95 wt%, preferably 70 to 90 wt% of vinyl chloride; 5 to 40 wt%, preferably 8 to 25 wt% of vinyl acetate; 0 to 20 wt%, preferably 0.5 to 10 wt% of hydroxy acrylate; 0 to 20 wt%, preferably 0.5 to 10 wt% of vinyl alcohol; and 0 to 10 wt%, preferably 0.5 to 5 wt% of maleic acid. The chloride-vinyl acetate resin has a number-average molecular weight of 10000 to
15 50000, preferably 13000 to 42000. Said chloride-vinyl acetate resin is commercially available, such as E15/45M from Eastman, VINNOL LL4320 from WACKER (Germany), UCAR VAGH, UCAR VAGK and VMCH from UCAR (USA), T-33 from BSK (Canada), and SOBIN A from SOBIN (Japan), etc.

Said chloride-vinyl acetate resin is insoluble in alcohol solvents, for example, vinyl
20 chloride-vinyl acetate is insoluble in alcohol, and therefore has high alcohol resistance. Since said topcoat and undercoat contain the chloride-vinyl acetate resin, they have alcohol resistance, and therefore will not be affected when the coating is scrubbed with alcohol or alcoholic solution. Since the intermediate coat does not contain the chloride-vinyl acetate resin, it has no alcohol resistance, and therefore, the residual intermediate coat on the
25 backlight part can be scrubbed off easily with alcohol or alcoholic solution.

Said coloring agent can be any conventional coloring agent used in the prior art coated products, for example, the coloring agent contained in said undercoat, intermediate coat, and topcoat can be each independently one or more selected from color slurry, pearlescence, fluorescent powder, dye, organic pigment, and inorganic pigment. Said organic pigment can
30 include, but not limited to carbon black and titanium white. Said organic pigment can include, but not limited to azoic triaryl methane, anthraquinone, phthalocyanine, thioindigo, isoindazole ketone, quinaldine ketone, triphenyl diazine, and methylenimine groups, etc. Said coloring agent is commercially available, for example, the white color slurry can be Dema TC21 from

Shibis or oily color slurry 844-0061 from DEGUSSA.

The coloring agent contained in the undercoat can be selected with reference to the expected backlight color; and the coloring agent contained in the topcoat can be determined with reference to the appearance color of said multi-layer coated product as required, as long as the undercoat and the topcoat are in a different color. Said intermediate coat contains or doesn't contain the coloring agent; if said intermediate coat contains color blending agent, the color blending agent can be any one or a mixture of above coloring agents. Preferably, said intermediate coat is in black color, because a black intermediate coat has higher light absorbing capability and can absorb more laser radiation, to facilitate the black intermediate coat and the topcoat to burn quickly and form clear engraved pattern. More preferably, said intermediate coat contains carbon black to form a black intermediate coat. Since carbon black is easy to burn at heating, the intermediate coat containing carbon black can be easily removed by the laser engraving.

Said adjusting agent can be any conventional adjusting agent in the prior art coated products, for example, the adjusting agent contained in said undercoat, intermediate coat, and topcoat can be independently selected from cellulose acetate butyrate (CAB) and rottweil powder. Said adjusting agent is used to adjust the arrangement of said coloring agent and surface properties of the coat layers. Said intermediate coat preferably contains CAB as the adjusting agent, because CAB can further reduce the alcohol resistance of the intermediate coat to easily remove the residual intermediate coat with alcohol or alcoholic solution.

The type and amount of said leveling agent is well known to those skilled in the art; for example, the leveling agent contained in said undercoat, intermediate coat, and topcoat can be each independently one or more selected from EFKA3883, EFKA3886, EFKA3600, EFKA3777, BYK366, BYK333, BYK307, and DEGO410. Among them, EFKA series are the products of EFKA (Netherland), BYK series are products of BYK Company, and DEGO series are products of DEGO (Germany); and above trade names are well known to those skilled in the art.

Said anti-settling agent is used to form powerful network structure in the resin composition to afford excellent thixotropic property to the system, so as to effectively prevent settlement and agglomeration of the color filler in the coating. The type and volume of said anti-settling agent are known to those skilled in the art; for example, Agent 201P or 229 from Taiwan Deuchem, DS6500/6800-20X or DS5000-10X from TAVY (USA), and 6900-20X or 4200-10 from Kusumoto Chemicals, Ltd. (Japan) can be used; above trade names are well known to

those skilled in the art.

The multi-layer coated product provided by the present invention can be used as a component for any appliance that requires backlight pattern, and is especially suitable for keyboards or keys of electronic products. As required, the intermediate coat and topcoat in the backlight pattern part can be removed to expose the undercoat and exhibit the backlight pattern. Said substrate can be any conventional substrate applicable to components that require backlight pattern, and plastic material is preferred.

The preparation method for multi-layer coated product provided by the present invention includes the step of forming an undercoat and a topcoat which have alcohol resistance and are in a different color from each other on a substrate in sequence, wherein it further includes the step of forming an intermediate coat having no alcohol resistance between the undercoat and the topcoat.

Wherein, said undercoat, topcoat, and intermediate coat can be formed by any conventional coating preparation method, respectively. For example, the coating composition can be mixed with a diluting agent, and the mixture is coated on the substrate and then dried. The coating composition can be mixed with the diluting agent at a weight ratio of 1: 0.5-2. Said drying method can be any prior art method, preferably drying for 5-15min. at 50-60°C. Said diluting agent can be any conventional diluting agent in the field, such as one or more of toluene, ethyl acetate, butyl acetate, isobutyl acetate, propyl acetate, ethanol, normal butyl alcohol, cyclohexanone, dimethylbenzene, methylisobutyl ketone, acetone, butanone, ethylene glycol monobutyl ether, and propylene glycol monobutyl ether.

Said undercoat can be formed with a prime coating composition; said topcoat can be formed with a finish coating composition; and said intermediate coat can be formed with an intermediate coating composition. The prime coating composition, finish coating composition, and intermediate coating composition each have the same components as the undercoat, topcoat, and intermediate coat, respectively, with the only difference that the coating compositions further contain a diluting agent. Wherein, the type and amount of said diluting agent are known to those skilled in the art. Relative to 100 parts by weight of the film-forming material, the amount of said diluting solvent is preferably 5 to 150 parts by weight, and more preferably 10 to 120 parts by weight.

Since the prime coating composition and the finish coating composition contain chloride-vinyl acetate resin having the alcohol resistance, the diluting agent in them can not be alcohol solely. In said prime coating composition and finish coating composition, said diluting agent can be

one or more of toluene, ethyl acetate, butyl acetate, isobutyl acetate, propyl acetate, cyclohexanone, dimethylbenzene, methylisobutyl ketone, acetone, butanone, ethylene glycol monobutyl ether, and propylene glycol monobutyl ether, or a mixture of ethanol and/or normal butyl alcohol with one or more of the above diluting agents. In said intermediate coating composition, said diluting agent can be one or more of toluene, ethyl acetate, butyl acetate, isobutyl acetate, propyl acetate, ethanol, normal butyl alcohol, cyclohexanone, dimethylbenzene, methylisobutyl ketone, acetone, butanone, ethylene glycol monobutyl ether, and propylene glycol monobutyl ether.

Above coating compositions can be prepared with the preparation method for conventional coating compositions, for example, the components of above coating layers, such as film-forming material and optional chloride-vinyl acetate resin, coloring agent, adjusting agent, auxiliary agent, and diluting solvent, can be mixed homogeneously.

Hereunder the present invention will be described in more detail in the examples.

15 Examples 1 to 5

The examples 1 to 5 are provided to prepare the coating compositions that form the coating layers.

The components shown in Table 1 were mixed homogeneously, the mixture was filtered to obtain a slurry, and then the slag was removed therefrom, to obtain the coating compositions A1, A2, A3, B1, and B2. The amount of the components in Table 1 was denoted in parts by weight.

Table 1

Component		Example 1	Example 2	Example 3	Example 4	Example 5
		A1	A2	A3	B1	B2
Film-forming material	Type	Thermoplastic acrylic resin (Mitsubishi 2952)	Thermoplastic acrylic resin (Mitsubishi 2952)	Thermoplastic acrylic resin (Mitsubishi 2952)	Thermoplastic acrylic resin (Mitsubishi BR113)	Thermoplastic acrylic resin (Mitsubishi BR113)
	amount	100	100	100	100	100
Chloride-vinyl acetate resin	Type	Vinyl chloride-vinyl acetate-maleate (VMCH from UCAR)	Vinyl chloride-vinyl acetate (SOBIN C from SOBIN (Japan))	Vinyl chloride-vinyl acetate-dicarbonate (LL4320 from WACKER)	-	-
	amount	25	30	15	0	0
Coloring agent	Type	White color slurry (Dema TC25 from Shibis)	Red color slurry (Dema TC29 from Shibis)	Green color slurry (Dema TC24 from Shibis)	Black color slurry (Dema TC21 from Shibis)	Black color slurry (Dema TC21 from Shibis)
	amount	60	40	50	50	50
Adjusting agent	Type	CAB resin (Eastman CAB381-20BP)	-	CAB resin (Eastman CAB381-20BP)	CAB resin (Eastman CAB381-0.5)	CAB resin (Eastman CAB381-0.5)
	amount	10	0	8	10	9
Anti-settling agent	Type	-	201P from Taiwan Deuchem	201P from Taiwan Deuchem	201P from Taiwan Deuchem	201P from Taiwan Deuchem
	amount	0	3	3	3	3
Leveling agent	Type	EFKA3883	EFKA3883	-	-	EFKA3883
	Volume	2	2	0	0	2
Diluting agent	Type	Ethyl acetate and acetone at a weight ratio of 1: 2	Ethyl acetate and toluene at a weight ratio of 1: 2	Ethyl acetate and acetone at 1: 2 weight ratio	Ethyl acetate and alcohol at 1: 2 weight ratio	Ethyl acetate and normal butyl alcohol at 1: 2 weight ratio
	amount	120	100	100	120	100

Example 6

The example 6 is provided to describe the multi-layer coated product and the preparation method thereof according to the present invention.

The coating composition A1 obtained in the example 1 was mixed with ethyl acetate in a weight ratio of 1: 0.8, and then the mixture was coated on a transparent thermoplastic keyboard, and baked for 10min. at 60°C to form the undercoat. Next, with the same method, the intermediate coat and topcoat were formed in sequence with the coating composition B1 obtained in example 4 and the coating composition A2 obtained in example 2, to obtain the multi-layer coated product D1.

Examples 7 to 11

The examples 7 to 11 are provided to describe the multi-layer coated product and the preparation method thereof according to the present invention.

5 With the method used in example 6, the undercoat, intermediate coat and topcoat were formed on a transparent thermoplastic keyboard in sequence, to obtain the multi-layer coated products D2 to D6. The coating compositions used to form the undercoat, intermediate coat and topcoat were shown in Table 2 below.

Comparative examples 1 to 3

10 The comparative examples 1-3 are provided to describe the multi-layer coated products of the prior art.

With the method used in example 6, the undercoat, and topcoat were formed on a transparent thermoplastic keyboard in sequence, to obtain the multi-layer coated products CD1, CD2, and CD3. The coating compositions used to form the undercoat and topcoat were shown in Table
15 2 below.

Examples 12 to 17

The examples 12-17 are provided to describe the influence of the multi-layer coated products D1 to D6 prepared in examples 6-11 on the laser engraving process.

20 A letter "A" was engraved on the multi-layer coated products D1 to D6 prepared in examples 6 to 11 with a laser engraving machine. The laser engraving process included a pre-commissioning procedure and a post-engraving alcohol scrubbing procedure. The pre-commissioning procedure shall be carried out appropriately to ensure the engraved pattern exhibits the undercoat color, avoid residual intermediate coat or topcoat as far as possible, and
25 prevent laser penetration into the undercoat. The post-engraving alcohol scrubbing procedure shall be carried out appropriately to ensure the dust produced in laser engraving is removed and the residual intermediate coat or topcoat is scrubbed off completely, so that the undercoat is exposed. The time for the pre-commissioning procedure, and the time for the post-engraving alcohol scrubbing procedure were recorded, and the sum of them, i.e., the total time, was
30 calculated. The result was shown in Table 2.

Comparative examples 4 to 6

The comparative examples 4 to 6 are provided to describe the influence of the multi-layer

coated products CD1, CD2 and CD3 prepared in the comparative examples 1 to 3 on the laser engraving process.

A letter "A" was engraved on the multi-layer coated products CD1, CD2 and CD3 prepared in the comparative examples 1-3 with the method used in examples 12-17. The time for the pre-commissioning procedure, the time for the post-engraving alcohol scrubbing procedure, and the total time were recorded. The result was shown in Table 2.

Table 2

Example No.	Multi-layer Coated Product No.	Coating Composition	Time (min.) for the Pre-Commissioning Procedure	Time (min.) for the Alcohol Scrubbing Procedure	Total Time (min.)
Example 12	D1	A1+B1+A2	2	0.5	2.5
Example 13	D2	A1+B2+A2	2	0.5	2.5
Comparative Example 4	CD1	A1+A2	8	5	13
Example 14	D3	A1+B1+A3	1.5	0.5	2
Example 15	D4	A1+B2+A3	2	0.5	2.5
Comparative Example 5	CD2	A1+A3	10	6	16
Example 16	D5	A2+B1+A3	2	0.5	2.5
Example 17	D6	A2+B2+A3	1.5	0.5	2
Comparative Example 6	CD3	A2+A3	9	8	17

It could be seen from the result in Table 2 that compared to the multi-layer coated products CD1, CD2 and CD3 obtained in the comparative examples 1-3, the multi-layer coated products D1 to D6 obtained in examples 6 to 11 of the present invention requires much less time for the pre-commissioning procedure and alcohol scrubbing procedure during the laser engraving process, which indicates that the production efficiency of the multi-layer coated product according to the present invention is prominently increased.

Claims

1. A multi-layer coated product, comprising:
a substrate, and
5 a multi-layer coating including an undercoat and a topcoat which are formed on the substrate in sequence, have alcohol resistance, and are in a different color from each other, wherein the multi-layer coating further includes an intermediate coat having no alcohol resistance between the undercoat and the topcoat.
- 10 2. The product according to claim 1, wherein the undercoat, the topcoat, and the intermediate coat each independently have a thickness of 3 to 15 μm .
- 15 3. The product according to claim 1, wherein the undercoat and the topcoat each independently contain 100 parts by weight of a film-forming material, 2 to 50 parts by weight of chloride-vinyl acetate resin, 3 to 80 parts by weight of a coloring agent, 0 to 20 parts by weight of an adjusting agent and 0 to 20 parts by weight of an auxiliary agent; and the intermediate coat contains 100 parts by weight of a film-forming material, 0 to 80 parts by weight of a coloring agent, 0 to 20 parts by weight of an adjusting agent and 0 to 20 parts by weight of an auxiliary agent.
- 20 4. The product according to claim 3, wherein the film-forming material contained in the undercoat, the intermediate coat, and the topcoat is each independently one or more selected from a thermoplastic acrylate resin, a hydroxy acrylic resin, a self-curing alkyd resin, and an aldehyde ketone resin.
- 25 5. The product according to claim 3, wherein the chloride-vinyl acetate resin contained in the undercoat and the topcoat is each independently one or more selected from vinyl chloride-vinyl acetate, vinyl chloride-vinyl acetate-hydroxy acrylate, vinyl chloride-vinyl acetate-maleate, and vinyl chloride-vinyl acetate-vinyl alcohol ester; based on its total weight, the chloride-vinyl acetate resin contains 50 to 95 wt% of vinyl chloride, 5 to 40 wt% of vinyl acetate, 0 to 20 wt% of hydroxy acrylate, 0 to 20 wt% of vinyl alcohol, and 0 to 10 wt% of maleic acid; and the chloride-vinyl acetate resin has a number-average molecular weight of 10000 to 50000.
- 30

6. The product according to claim 3, wherein the coloring agent contained in the undercoat, the intermediate coat, and the topcoat is each independently one or more selected from color slurry, pearlescence, fluorescent powder, dye, organic pigment, and inorganic pigment.

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7. The product according to claim 6, wherein the coloring agent contained in the intermediate coat is carbon black which is a kind of the organic pigment.

8. The product according to claim 3, wherein the adjusting agent contained in the undercoat, the intermediate coat, and the topcoat is each independently selected from cellulose acetate butyrate and rottweil powder; and the auxiliary agent contained in the undercoat, the intermediate coat, and the topcoat is each independently selected from anti-settling agent and leveling agent.

9. A method for preparing a multi-layer coated product, including the step of forming an undercoat and a topcoat which have alcohol resistance and are in a different color from each other on a substrate in sequence, wherein it further includes the step of forming an intermediate coat having no alcohol resistance between the undercoat and the topcoat.

10. The method according to claim 9, wherein the undercoat is formed from a prime coating composition, the topcoat is formed from a finish coating composition, and the intermediate coat is formed from an intermediate coating composition; the prime coating composition and the finish coating composition each independently contain 100 parts by weight of a film-forming material, 2 to 50 parts by weight of chloride-vinyl acetate resin, 3 to 80 parts by weight of a coloring agent, 5 to 150 parts by weight of a diluting agent, 0 to 20 parts by weight of an adjusting agent and 0 to 20 parts by weight of an auxiliary agent; and the intermediate coating composition contains 100 parts by weight of a film-forming material, 5 to 150 parts by weight of a diluting agent, 0 to 80 parts by weight of a coloring agent, 0 to 20 parts by weight of an adjusting agent and 0 to 20 parts by weight of an auxiliary agent.

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11. The method according to claim 10, wherein the film-forming material contained in the prime coating composition, the intermediate coating composition, and the finish coating composition is each independently one or more selected from a thermoplastic acrylate resin, a hydroxy acrylic resin, a self-curing alkyd resin, and an aldehyde ketone resin.

12. The method according to claim 10, wherein the chloride-vinyl acetate resin contained in the prime coating composition and the finish coating composition is each independently one or more selected from vinyl chloride-vinyl acetate, vinyl chloride-vinyl acetate-hydroxy acrylate, vinyl chloride-vinyl acetate-maleate, and vinyl chloride-vinyl acetate-vinyl alcohol ester; based on its total weight, the chloride-vinyl acetate resin contains 50 to 95 wt% of vinyl chloride, 5 to 40 wt% of vinyl acetate, 0 to 20 wt% of hydroxy acrylate, 0 to 20 wt% of vinyl alcohol, and 0 to 10 wt% of maleic acid; and the chloride-vinyl acetate resin has a number-average molecular weight of 10000 to 50000.

INTERNATIONAL SEARCH REPORT

International application No.
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A. CLASSIFICATION OF SUBJECT MATTER <p style="text-align: center;">See extra sheet</p> 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) <p style="text-align: center;">IPC: B32B, B05D, C08J7, G06F3, H01H13, H04M1</p> 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) CNPAT,CNKI,WPI,EPODOC,PAJ, coat+, key+, alcohol, colo?r?,engrav+, etch+,multi+,button?				
C. DOCUMENTS CONSIDERED TO BE RELEVANT				
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.		
A	CN2179984Y(XULI CO LTD), 19 OCT. 1994(19.10.1994), the whole document	1-12		
A	CN1208883A(XULI CO LTD), 24 FEB. 1999(24.02.1999), the whole document	1-12		
A	US5894039A(SILITEK CORP), 13 APR. 1999(13.04.1999), the whole document	1-12		
<input type="checkbox"/> Further documents are listed in the continuation of Box C. <input checked="" type="checkbox"/> See patent family annex.				
<table style="width: 100%; border: none;"> <tr> <td style="width: 50%; border: none; vertical-align: top;"> * Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "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) "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 </td> <td style="width: 50%; border: none; vertical-align: top;"> "T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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 "&"document member of the same patent family </td> </tr> </table>			* Special categories of cited documents: "A" document defining the general state of the art which is not considered to be of particular relevance "E" earlier application or patent but published on or after the international filing date "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) "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	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention "X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone "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 "&"document member of the same patent family
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Date of the actual completion of the international search <p style="text-align: center;">24 DEC. 2007(24.12.2007)</p>	Date of mailing of the international search report <p style="text-align: center;">10 Jan. 2008 (10.01.2008)</p>			
Name and mailing address of the ISA/CN The State Intellectual Property Office, the P.R.China 6 Xitucheng Rd., Jimen Bridge, Haidian District, Beijing, China 100088 Facsimile No. 86-10-62019451	Authorized officer <p style="text-align: center;">ZHAO Yan</p> Telephone No. (86-10)62086482			

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
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