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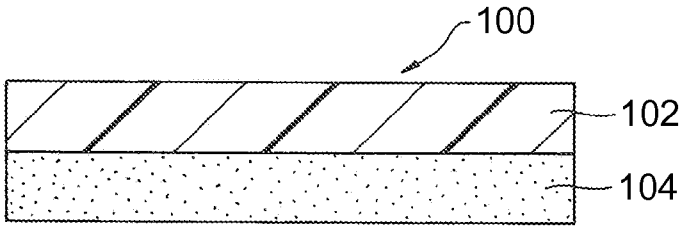

Fig. 1

(57) Abstract: The present invention provides a light accumulating laminated layer body that has appropriate flexibility properties relative to interior and exterior road surfaces, stairs, wall surfaces, etc., wavy surfaces (possessing indentations and protrusions), has compliant properties, is thin and has excellent light accumulation capability.

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LIGHT ACCUMULATING LAMINATED BODY

TECHNICAL FIELD

The present invention relates to light accumulating laminated layer bodies. In particular, the present invention relates to light accumulating laminated layer bodies that have been laminated with an acrylic type white color adhesive agent layer.

BACKGROUND

Sheet or flooring material utilizing a light accumulating material can be used in practice. In the use of such a sheet or flooring material, a material may be chosen that generates light in the dark from the energy of the light that is absorbed by the light accumulating material. These sheets or flooring materials can be used as disaster prevention markings, safety markings, or as different types of design indicators. If at the time the light accumulating material generates light on its back surface a light suppression layer is provided, the light accumulating capability is further increased. Because of this, a material that has suppression properties may be provided on the back surface of the layer containing the light accumulating material. In this case, on such the layer with suppression properties, an adhesive agent layer can be provided.

SUMMARY

The present invention relates to a light accumulating laminated layer body that contains a light accumulating layer and a layer laminated on the light accumulating layer. The laminate layer may be an acrylic type white color adhesive agent layer. The adhesive agent layer may contain a carboxylic radical containing (meth) acrylic type polymer, a white color pigment agent, and a (meth) acrylic type polymer, which contains an amino radical and does not contain aromatic vinyl monomer.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a cross sectional view diagram showing one example of the light accumulating laminated layer material according to the present description.

Figs. 2a and 2b are figures showing one example of the light accumulating laminated layer material according to the present description, where Fig. 2a represents a three-dimensional view and Fig. 2b represents a cross sectional view.

Fig. 3 is a cross sectional view diagram showing one example of the light accumulating laminated layer material according to the present description.

Fig. 4 is a graph that shows the ratio of brightness decrease that occurs on the black color parts measured according to the Reference Practical Test 1.

Fig. 5 is a graph showing the measurements according to the Reference Practical test 2 90 degree peel adhesive force (N/25 mm) after 24 hours (1 day).

Fig. 6 is a graph showing the measurements according to the Reference Practical test 2 90 degree peel adhesive force (N/25 mm) after one week period.

Figs. 7a, 7b, and 7c are photographs taken as each respective sample was glued onto the sheet used for the testing of the hiding properties according to the Reference Test 1.

DETAILED DESCRIPTION

The present invention provides a light accumulating laminated layer body that has appropriate flexibility properties relative to interior and exterior road surfaces, stairs, wall surfaces, etc., wavy surfaces (possessing indentations and protrusions). The body has compliant properties and is thin and has excellent light accumulation capability.

The present invention provides a light accumulating laminated layer body that has appropriate flexibility properties relative to wavy surfaces (possessing indentations and protrusions), has compliant properties, is thin and has excellent light accumulation capability. The present invention also suggests a light accumulating laminated layer body that can maintain adhesive (bonding) properties even at locations like interior and exterior road surfaces or wall surfaces, and stairs, etc. that can be wetted by water.

Fig. 1 represents a sectional view diagram showing one example of the light accumulating laminated layer body according to the present invention. It is a diagram that shows schematically one example of a sectional view diagram of the light accumulating laminated layer body 10 according to the present invention. The light accumulating laminated layer body 100 is a body where the light accumulating layer 102 and the acrylic type white color adhesive agent layer (or laminate) 104 have been layer laminated.

The light accumulating layer 102 is formed from a resin containing light accumulating fluorescent material. There are no particular limitations regarding the resin material. For example, the materials used according to the previous technology can be used. However, it is possible to use any one type of the following materials or a mixture of two or more types of them: transparent and flexible properties possessing polyurethanes, vinyl chloride type polymers, acrylic type polymers, polyesters, polyolefins, polystyrenes, silicones, fluorinated type polymers, or epoxy type polymers, amongst others. Then, optionally, it is also possible to add a crosslinking agent and crosslink these polymer materials. Regarding the resin material, it may also be a material that contains surface improving agents, curing agents, coloring agents, anti-bacterial agents, additives, or other performance enhancing agent.

Regarding the light accumulating fluorescent material, it is possible, for example, to appropriately select aluminum acid salt type light accumulating fluorescent materials or sulfide compound type fluorescent light materials, etc., materials known from the previous technology, and there are no particular limitations. For example, in certain embodiments, it is possible to use GLL-300, G-300 (manufactured by Basic Specialty Science Company,

Europium doped (activated) – Dysprosium co-doped strontium salt of the aluminum acid (SrAlO4: Eu, Dy), or GSS (manufactured by Basic Specialty Science Company, copper doped – zinc sulfide (ZnS:Cu)).

The light accumulating layer according to the present invention is a layer that can be formed into the resin in pellet, paste, or powder form. A light accumulating fluorescent material is added to the desired mixture, and it is formed through the methods known from the previous technology like calendaring, extrusion molding or orientation (extension) etc.

There are no particular limitations regarding the thickness of the light accumulating layer, however, it can be in the range of approximately 0.1 mm to approximately 5 mm.

The laminate, or acrylic type white color adhesive agent layer 104 contains a carboxylic radical containing (meth) acrylic type polymer, a white color pigment agent, and a (meth) acrylic type polymer, which contains an amino radical and does not contain aromatic vinyl monomer.

In the description of the present invention, the term "(meth) acrylic" has the meaning of "acrylic or methacrylic". Also, the term "carboxylic radical containing (meth) acrylic type polymer" is said to be a "carboxylic radical containing polymer" and the term "(meth) acrylic type polymer containing an amino radical that does not contain aromatic vinyl monomer" is said to be an "amino radical containing polymer".

Regarding the acrylic type white color adhesive agent, a carboxylic radical containing polymer, which is a polymer obtained as carboxylic radical containing monomer, is used as the structural component and it is polymerized, Further, an amino radical containing polymer, which is a polymer obtained as amino radical containing monomer, is used as the structural component and it is polymerized. The two radicals are mixed and combined and by the mixture, properties of the white color pigment material inside the adhesive agent are improved and the white color pigment material is stably held

inside the adhesive agent. Because of this, it is possible to suggest white color adhesive agent containing larger amounts of pigment material.

Regarding the acrylic type white color adhesive agent, a particularly desirable adhesive agent is formed from (i) a carboxylic radical containing (meth) acrylic type adhesive polymer and also (ii) from white color pigment material in an amount of approximately 25 weight parts to approximately 150 weight parts relative to the above described carboxylic radical containing (meth) acrylic type polymer and an amino radical containing (meth) acrylic type polymer that does not contain aromatic vinyl monomer.

Through the incorporation of the above described coloring agent, namely, through the dispersing of the white color pigment material in advance in the polymer material, it is possible to stably disperse an even larger amount of white color pigment material inside the adhesive agent.

Carboxylic radical containing (meth) acrylic type polymer

Regarding the above described carboxylic radical containing (meth) acrylic type polymer, it is a polymer material that has mono ethylenic unsaturated monomer as its main component, and it is a material where part of it contains carboxylic radical containing mono ethylenic unsaturated monomer (carboxylic radical containing mono ethylenic unsaturated monomer). Regarding the above described mono ethylenic unsaturated monomer, it is a material whose main component is polymer, and usually, it can be represented by the formula $CH_2=CR^1COOR^2$ (where in the formula, R^1 represents hydrogen or a methyl radical, R^2 represents a linear chain, a cyclic or a branched type alkyl radical or phenyl radical, alkoxyl alkyl radical, phenoxy alkyl radical, hydroxy alkyl radical, cyclic ether radical). An appropriate monomer material, may be chosen, for example, from the following materials: methyl (meth) acrylate, ethyl (meth) acrylate, n-butyl (meth) acrylate, iso-amyl (meth) acrylate, n-hexyl (meth) acrylate, 2-ethyl hexyl (meth) acrylate, iso-octyl (meth) acrylate, iso-nonyl (meth) acrylate, decyl (meth) acrylate, or dodecyl (meth) acrylate, cyclo hexyl (meth) acrylate, etc., alkyl (meth) acrylate; phenoxy ethyl (meth) acrylate, etc., phenoxy alkyl (meth) acrylate; methoxy propyl (meth)

acrylate, 2-methoxy butyl (meth) acrylate, etc., alkoxyl alkyl (meth) acrylate; 2-hydroxy ethyl (meth) acrylate, 2-hydroxy propyl (meth) acrylate, 4 –hydroxy butyl (meth) acrylate, etc., hydroxy alkyl (meth) acrylate; glycidyl (meth) acrylate, tetra hydro furfuryl (meth) acrylate, etc., cyclic type ether containing (meth) acrylate, etc. Depending on the requirements (optionally), it is also possible to use one type or two or more types of mono ethylenic unsaturated monomers.

The carboxylic radical containing mono ethylenic unsaturated monomers, may be composed of acrylic acid, methacrylic acid, crotonic acid, etc., unsaturated monocarboxylic acid; itaconic acid, fumaric acid, citraconic acid, maleic acid, etc., unsaturated di-carboxylic acid; ω-carboxy polycapro lactone mono acrylate, β-carboxy ethyl acrylate, or 2 – (meth) acryloyl oxy ethyl succinic acid, etc.

The carboxylic radical containing (meth) acrylic type polymer may be obtained, for example, by copolymerization at a ratio of 80 to 99.5 weight parts of the above described mono ethylenic unsaturated monomer and 0.5 to 20 weight parts of the above described carboxylic radical containing mono ethylenic unsaturated monomer. Or, it can also be obtained as the amount of the mono ethylenic unsaturated monomer is made to be within the range of 90 to 99 weight parts and the amount of the carboxylic radical containing mono ethylenic unsaturated monomer is made to be within the range of 1 to 10 weight parts.

There are no particular limitations regarding the weight average molecular weight of the carboxylic radical containing (meth) acrylic type polymer, however, it can be a material where it is within the range from approximately 100,000 to approximately 2,000,000 or approximately 300,000 to approximately 1,000,000.

Regarding the carboxylic radical containing (meth) acrylic type polymer, it can be used as the main component of the acrylic type white color adhesive agent, and its compounded amount can be made to be within the range of approximately 35 weight parts to approximately 80 weight parts in the case when the acrylic type white color adhesive agent total amount is set as 100 weight parts.

Amino radical containing (meth) acrylic type polymer that does not contain aromatic vinyl monomer

The above described amino radical containing (meth) acrylic type polymer that does not contain aromatic vinyl monomer is a polymer that has mono ethylenic unsaturated monomer as its main component, where part amino radical containing unsaturated monomer is contained, and aromatic vinyl monomer is not contained as a structural component of the polymer material. Regarding such mono ethylenic unsaturated monomer, it is the same as the carboxylic radical containing (meth) acrylic type polymer in the agent and the above described aromatic vinyl monomers include styrene, α-methyl styrene, vinyl toluene, vinyl naphthalene, vinyl anthracene, vinyl anthracene quinone, (meth) acrylamide aromatic amines, or (meth) acrylates of hydroxyl radical containing aromatic compounds, etc. The aromatic amines may be aniline, benzyl amine, naphthyl amine, amino anthracene, amino anthrax quinone, or their derivatives. The hydroxyl radical containing aromatic compounds may be hydroxyl radical containing compounds corresponding to the above described aromatic amines. As the method for obtaining the amino radical containing (meth) acrylic type polymers, it is possible to use the method where mono ethylenic unsaturated monomer and amino radical containing unsaturated monomer are copolymerized.

For the amino radical containing unsaturated monomers, the following monomers may be used: N, N – dimethyl amino ethyl acrylate (DMAEA), N, N – dimethyl amino ethyl methacrylate (DMAEMA), etc., di alkyl amino alkyl (meth) acrylates; N, N – dimethyl amino propyl acrylamide (DMAPAA), N, N – dimethyl amino propyl methacryl amide, etc., dialkyl amino alkyl (meth) acrylamides; N, N – dimethyl amino ethyl vinyl ether, N, N – diethyl amino ethyl vinyl ether, etc., dialkyl amino alkyl vinyl ethers; or mixtures thereof.

The amino radical containing polymer can be obtained, for example, by the copolymerization of the mono ethylenic unsaturated monomer in an amount in the range of approximately 80 to approximately 99.5 weight parts and of the amino radical

containing unsaturated monomer in an amount in the range of approximately 0.5 to approximately 20 weight parts. Or it is also possible to set the amount of the mono ethylenic unsaturated monomer in the range of approximately 90 to approximately 99 weight parts and the amount of the amino radical containing unsaturated monomer within the range of approximately 1 to approximately 10 weight parts.

There are no particular limitations regarding the weight average molecular weight of the amino radical containing polymer, however, for example it can be made to be in the range of approximately 1,000 to approximately 500,000, approximately 5,000 to approximately 200,000 or approximately 10,000 to approximately 100,000.

Regarding the compounding amount of the amino radical containing polymer, in the case when the total amount of the acrylic type white color adhesive agent is taken as 100 weight parts, it can be made to be within the range of approximately 5 weight parts to approximately 20 weight parts. Also, in the case when the acrylic type white color adhesive agent contains a white color agent, it is possible to be used as one component of the appropriate coloring agent.

The copolymerization of these polymers can be conducted by radical polymerization. In this case, it is possible to use solution polymerization, suspension polymerization or agglomeration polymerization or other well known polymerization methods. As the initiation agent, it is possible to use the following agents: benzoyl peroxide, lauroyl peroxide, bis (4-ta shari – butyl cyclo hexyl) peroxy dicarbonate, etc., organic peroxides, or 2, 2' – azo bis iso-butylonitrile, 2, 2' – azo bis – 2 – methyl butylo nitrile, 4, 4' – azo bis – 4 – cyano valeric acid, 2, 2' – azo bis (2- methyl propionic acid) di m ethyl ester, azo bis 2, 4 – dimethyl valero nitrile (AVN), etc., azo type polymerization initiation agents. As the amount used of these polymerization initiation agents, when the monomer mixed material is taken as 100 weight parts, it can be set to be within the range of 0.05 to 5 weight parts.

White Color Pigment Material

The white color pigment material may be chosen, for example, from the following materials: zinc carbonate (zinc salt of carbonic acid), zinc sulfide, or titanium oxide (titanium dioxide). Also, optionally it is possible to use talcum, kaolin, calcium carbonate. These white color pigment materials can be used individually as single materials or it is possible to mix two type or more and use these mixtures. Also, these white color pigment materials can be in any type of form, or it is also possible that they are materials that have undergone different types of dispersing treatments according to the methods well known from the previous technology.

The contents of the white color pigment material can be appropriately selected so that it matches the predetermined hiding properties. For example, relative to 100 weight parts of the above described carboxylic radical containing (meth) acrylic type polymer material, it content can be made to be within the range of approximately 25 weight parts to approximately 150 weight parts.

Coloring Agent

The coloring agent contains white color pigment material and amino radical containing (meth) acrylic type polymer that does not contain aromatic vinyl monomer. Here, the white color pigment material and the amino radical containing (meth) acrylic type polymer that does not contain aromatic vinyl monomer are correspondingly according to the above reported description.

In the detailed description of the present invention the amino radical containing (meth) acrylic type polymer that does not contain aromatic vinyl monomer in the coloring agent is reported as “coloring agent polymer”. Also, polymer that is not originally in the coloring agent is reported as “adhesive agent polymer”.

Regarding the coloring agent polymer, from the stand point of maintaining long term stability properties, the polymers that are compatible with the above described adhesive agent polymer, are preferred.

The coloring agent may be obtained as the above described white color pigment material and the above described coloring agent polymer are mixed according to the methods of the previous technology. For example, they can be obtained by mixing using a paint shaker, sand grind mill, ball mill, attritor mill, or three-body roll mill, etc. At this time, optionally (depending on the requirements), it is also possible to add an aqueous type or an organic type solvent medium.

The coloring agent is preferably a material where pigment particles do not agglomerate and also where the material is maintained in a well dispersed state both immediately after the manufacturing, of course, and even after the passing of prolonged period of time (for example, to the level of approximately 1 month) after the manufacturing and preparation. These conditions are the same not only in the case of preparation and manufacturing using, for example, the sand grind mill, ball mill, attritor mill, or three-body roll mill, etc., devices with relatively strong mixing force, but also in the case of using a paint shaker, etc., devices with relatively weak mixing force. In the case when devices with relatively weak mixing forces are used, by mixing and combining for a relatively short period of time (for example, approximately 10 minute level), it is possible to obtain materials that are maintained in a well dispersed state both immediately after the manufacturing, of course, and even after the passing of prolonged period of time after the manufacturing and preparation.

Crosslinking Agent

The acrylic type white color adhesive agent can optionally also contain a crosslinking agent. Such an agent may be chosen from the following materials, amongst others: bis amide type crosslinking agent (for example, 1, 1' – iso-phthaloyl bis (2-methyl azilidine)), azilidine type crosslinking agents (for example, the manufactured by Nippon Catalyst Company Chemilite PZ33, the manufactured by Abishia, NeoCryl CX-100),

carbo di-imide type crosslinking agents (for example, the manufactured by Nishinbo Company, Carbodilite V-03, V-05, V-07), epoxy type crosslinking agents (for example, the manufactured by Soken Kagaku Company, E-AX, E-5XM, E5C), isocyanate type crosslinking agents (for example, the manufactured by Nippon Polyurethane Coronate L, Coronate HK, the manufactured by Bayer Company, Desmodur H, Desmodur W, Desmodur I).

Regarding the added amount of the crosslinking agent, it can be made to be from 0.01 to 0.5 equivalent amount relative to the carboxylic radical in the carboxylic radical containing polymer or relative to the amino radical in the amino radical containing polymer.

The white color agent can be obtained as the above described white color pigment material and the above described amino radical containing (meth) acrylic type polymer that does not contain aromatic vinyl monomer are mixed according to the previous technology methods.

For example, it can be obtained as each of the components are introduced almost simultaneously in the mixing device and are mixed by using a paint shaker, sand grind mill, ball mill, attritor mill, or a three-body roll mill, etc. At this time, optionally (depending on the requirements), it is possible to use the above described crosslinking agent or the well known aqueous or organic type solvent media. It is also possible that the above described white color pigment material is mixed in an aqueous or organic type solvent medium and after that it is mixed with the other ingredients.

Also, in the case when the acrylic type white color adhesive agent contains a coloring agent, it can be obtained as the carboxylic radical containing acrylic type polymer and the coloring agent are mixed and combined according to the previous technology methods.

The acrylic type white color adhesive agent layer naturally has adhesive properties, and because of the fact that it contains a significant amount of white color pigment

material, it also is equipped with sufficient hiding properties. By layer laminating such adhesive agent layer on the light accumulating layer of the light accumulating laminated layer body according to the present invention, it becomes necessary to use the two layers – the hiding properties possessing layer and the adhesive layer. Then, even if the thickness of the white color adhesive agent layer is made to be thin, it is possible to obtain sufficient hiding properties. And because of that it is possible to limit the thickness of the total body of the light accumulating laminated layer body.

The thickness of the acrylic type white color adhesive agent layer is not particularly limited. For example, it can be made to be from approximately 0.02 mm to approximately 0.1 mm.

At the time when the light accumulating layer generates light it can be reflected by the acrylic type white color adhesive agent layer and because of that the light generation efficiency is increased.

Fig. 2a is a three-dimensional diagram showing one example of the light accumulating laminated layer body according to the present invention. Fig. 2b is a sectional view diagram showing the light accumulating laminated layer body from Fig. 2a.

The light accumulating layer 202 can be a layer with a structure formed from the light accumulating part 203 consisting of resin incorporating a light accumulating fluorescent material and from the support part 205 formed from a resin, which practically does not contain light accumulating fluorescent material. For the example shown in Figs. 2a and 2b, there are no particular limitations regarding the resin that can be used in the light accumulating part 203 and the supporting part 205. For example, it is possible to use the resin that is transparent and that has flexibility properties such as that reported according to the explanation of Fig. 1.

There are no particular limitations regarding the shapes of the light accumulating part 203 and the supporting part 205, the surface area ratio of the light accumulating part 203 and the supporting part 205, or their volume ratio, and they can be appropriately

selected depending on the different conditions. In order to increase the light generation efficiency of the light accumulating part 203 it is preferred that the light accumulating part 203 and the acrylic type white color adhesive agent layer 204 are in contact.

Fig. 3 is a cross sectional view diagram showing one example of the light accumulating laminated layer body according to the present invention. The light accumulating laminated layer body 300 has a structure that can be formed from the light accumulating layer 302, the acrylic type white color adhesive agent layer 304 and the floor surface adhesive agent layer 306. The floor surface adhesive agent 306 is effective in order to maintain the bonding strength at the time when the light accumulating laminated layer body 300 is adhered to surfaces. This is true on surfaces that have protrusions and indentations, or at time when gluing on mainly outdoor, etc., locations with high humidity or locations that can be easily wetted by water from rain or snow.

With regard to the floor surface adhesive agent, it is possible to use the adhesive agents according to the previous technology and there are no particular limitations. For example, it is possible to use acrylic type adhesive agents, silicone type adhesive agents, rubber type adhesive agents, or urethane type adhesive agents, etc. From the standpoint of the water resistant properties and the compliant properties the rubber type adhesive agents (for example, NBR, etc.) can be listed as the preferred agents. Also, the usual surface road materials in many cases are materials that have low polarity properties and because of that the use of the silicone type adhesive agents, or the rubber type adhesive agent, etc., adhesive agents with low polarity properties is preferable since their bonding properties become good.

There are no particular limitations regarding the thickness of the floor surface adhesive agent layer, and for example, the thickness can be in the range of approximately 0.01 mm to approximately 0.5 mm, or approximately 0.03 mm to approximately 0.2 mm.

In order to protect the adhesive agent layer, a liner may be provided on the light accumulating laminated layer body. Regarding this liner, it is a good option if it is the liner that is generally used in the adhesive tape industry, etc. and there are no limitations to

particular materials. As appropriate liners, for example, it is possible to list paper; polyethylene, polypropylene, polyester, or cellulose acetate, etc., plastic materials; or paper materials that are covered or laminated with such plastic materials, etc., materials. These liners can be used in the state as they are, and that is a good option, however, it is possible that they are materials obtained after a treatment for improving their release properties has been conducted by using silicone treatment or other methods.

Regarding the light accumulating laminated layer body, it may be preferable that it also contain a surface protection layer or a primer layer, etc., functional layers. Also, it is a good option if at the time when the light accumulating laminated layer body is being glued on the material subject to the adhesion a general used primer is coated on the surface subject to the adhesion. Usually, by such primer treatment, the adhesive force between the light accumulating laminated layer body and the material subject to the adhesion can be increased.

Also, on the surface of the light accumulating layer (on one part or on the whole surface), it is possible to provide a semi-spherically shaped or pyramidal-shaped micro-structure (fine, small protrusions). By providing such fine micro-structure it is possible to obtain an anti-slip effect or an anti-staining effect.

Examples

Light Accumulating Layer

A layer of polyvinyl chloride (manufactured by Shinetsu Polymer Company, TUJ-7854) containing 30 weight parts of light accumulating fluorescent material (manufactured by Basic Specialty Science Company GLL-300M) was prepared.

Manufacturing of the acrylic type white color adhesive agent layer

Relative to 10 weight parts of acrylic resin 1 (methyl methacrylate (MMA)/butyl methacrylate (BMA)/di-methyl- amino – ethyl – methacrylate, DEMAEMA) copolymer, with a compositional ratio of 60:34:6 (weight ratio), molecular weight (Mw) of 68,000, and with a Tg of 63°C (calculated value), ethyl acetate solution (where the solids are 39 %), and to 50 weight parts of pigment material 1 (white color pigment material, manufactured by DuPont Ti Pure R960, titanium dioxide), 40 weight parts of methyl iso-butyl ketone, are added and by using a paint shaker (manufactured by Thinky Company, ARE250), it was stirred for a period of 10 minutes and the pigment material premix solution was obtained.

After that relative to 100 weight parts of the adhesive agent 1 (butyl acrylate (BA)/acrylonitrile (AN)/acrylic acid (AA) copolymer, with a compositional ratio of 92:3:5 (as a weight ratio), acrylic type adhesive agent, where the solvent agent is ethyl acetate, the weight average molecular weight is 360,000 and the Tg is -46oC (calculated value)), the adhesive agent and the above described premix are mixed so that the pigment material becomes 40 weight parts and the acrylic resin 1 becomes 8 weight parts, and by that the white color adhesive agent composition material solution was prepared. Relative to 100 weight parts of the adhesive agent 1, an amount of 0.2 weight parts of the crosslinking agent 1 (1, 1' – iso-phthaloyl – bis (2-methyl azilidine), toluene solution where the solids content is 5 %) was added. The above described adhesive agent composition material was coated by using a knife coater on the surface of a release paper formed from a base paper that has been laminated on both sides with polyethylene so that the thickness after drying would become 30 microns; this was then dried at a temperature of 90°C for 5 minutes and it was dried and crosslinked (cured).

Floor surface adhesive agent layer

A rubber type adhesive agent (GRN – 13B, manufactured by Big technos Company) and polyisocyanate crosslinking agent (Coronate L-55E, manufactured by Nippon Polyurethane Industries), were mixed at a ratio of 100:1 (by weight) and by using

toluene as the solvent agent, it was adjusted so that the solids became approximately 30 % and this was coated by using a knife coater on the surface of a release paper formed from a base paper that has been laminated on both sides with polyethylene so that the thickness after drying would become 30 microns and it was then dried at a temperature of 90°C for 5 minutes and it was dried and crosslinked (cured).

Example 1

The acrylic type white color adhesive agent layer and the floor surface adhesive agent layer were glued and combined and the adhesive agent layer laminated body was obtained. On the above described obtained light accumulating layer, a primer (manufactured by Sumitomo Company, N200), was coated and dried and the acrylic type white color adhesive agent layer of the above described adhesive agent layer laminated layer body, was glued and combined through lamination and the light accumulating laminated layer body was obtained.

Example 2

A laminate body was prepared as described in Example 1. On the back side of the polyvinyl chloride resin layer (TUJ-7854, manufactured by Shinetsu Polymer Company) containing 30 weight parts of light accumulating fluorescent material (GLL-300M, manufactured by Basic Specialty Chemicals Company), a primer (manufactured by Sumitomo Company, N-200), was coated and dried and after that a polyisocyanate crosslinking agent (a solution where the manufactured by Nippon Polyurethane Industries Coronate L-55E has been mixed at 100:1) was coated by using a knife coater so that the thickness after drying would become 80 microns and it was dried and the light accumulating laminated layer body, was obtained.

Example 3

A laminate body was prepared as described in Example 1. On the back side of the polyvinyl chloride resin layer (TUJ-7854, manufactured by Shinetsu Polymer Company)

containing 30 weight parts of light accumulating fluorescent material (GLL-300M, manufactured by Basic Specialty Chemicals Company), a primer (manufactured by Sumitomo Company, N-200), was coated and dried and after that a solution, which was obtained as a floor surface adhesive agent solution (rubber type adhesive agent (GRN-13B manufactured by Big Technos Company) containing 50 weight parts of white color pigment material (manufactured by Sumitomo Company, BW9310 (alkyd white color pigment dispersion), and a polyisocyanate crosslinking agent (manufactured by Nippon Polyurethane Industries Coronate L-55E), were mixed at 100:1, was coated by using a knife coater so that the thickness after drying would become 80 microns and it was dried and the light accumulating laminated layer body, was obtained.

Reference Practical Test 1: Measurement of the light accumulating performance

On a sheet that has been printed with both black color and white color and that is used for testing the hiding properties, the light accumulating laminated layer materials that have been obtained according to the Example 1, 2, and 3 were glued and according to the procedures of JIS Z 9107 6.3.2 and the residual light brightness (following a sudden darkening after an irradiation by using the normally used light source lamp D65 at 200 Lux for a period of 20 minutes) was measured by using a brightness measurement system as the light accumulating capabilities of the corresponding black parts and white parts. The glued samples from Examples 1, 2, and 3 are displayed in Figs. 7a, 7b, and 7c. The residual light brightness values are shown in Table 1 and the black color parts brightness decrease ratios are shown correspondingly in Fig. 4.

Table 1

mcd/m2	0.1	0.5	1	2	3	5	10	20	30	60
1*	2090	1430	1180	890	710	460	230	110	80	40
2*	1990	1410	1150	870	700	470	230	100	70	40
3*	1740	1250	1020	760	600	380	190	90	60	30
4*	1260	820	640	430	310	180	100	50	50	30
5*	1800	1320	1080	810	650	430	200	100	70	40
6*	1730	1280	1060	800	620	410	200	90	70	40

* In the table: 1. Example 1: white backing; 2. Example 1: black backing; 3. Example 2: white backing; 4. Example 2: black backing; 5. Example 3: white backing; 6. Example 3: black backing.

Adhesive properties performance

The Example 2 and the Example 3 light accumulating laminated layer materials were cut to a 25 mm width and they were glued onto a mortar plate and the 90 degree peel force (N/25 mm) was measured by a digital force gauge (manufactured by Imada Company) after a period of 24 hours (one day) and after a period of one week in a moisture-proof type equipment (65°C, 95 %) and the adhesive properties were measured. The results for one day are correspondingly shown in Fig. 5. Similarly, the results for one week are shown in Fig. 6 with two mortar surface finishes (smooth/flat, and non-flatt/wavy). The values in both graphs are the adhesive strength (N/25 mm + standard deviation).

CLAIMS

What is claimed is:

1. Light accumulating laminated layer body comprising:

a light accumulating layer; and

a laminate positioned on the light accumulating layer, the laminate comprising (i) a carboxylic radical containing (meth) acrylic type polymer, (ii) a white color pigment agent, and (iii) an amino radical containing, non-aromatic vinyl (meth) acrylic type polymer.

2. The light accumulating laminated layer body of claim 1, wherein the laminate comprises 25 to 150 weight parts of white color pigment agent relative to 100 weight parts of carboxylic radical containing (meth) acrylic type polymer.

3. The light accumulating laminated layer body of claim 1 or 2, wherein the thickness of the laminate is in the range of 0.02 mm to 0.1 mm.

4. The light accumulating laminated layer of claim 1, 2, or 3, wherein the light accumulating layer comprises a light accumulating portion and a supporting portion.

5. The light accumulating laminated layer body of claim 1, 2, 3, or 4, further comprising a floor surface adhesive agent layer, the floor surface adhesive agent being layer laminated to the light accumulating laminated layer body.

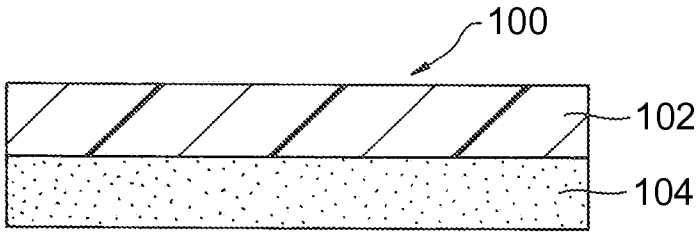

Fig. 1

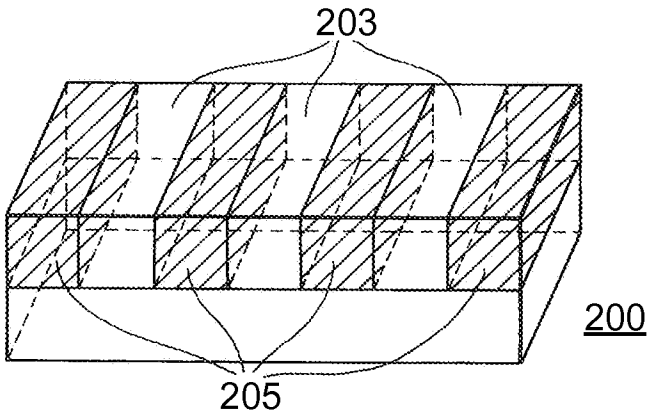

Fig. 2a

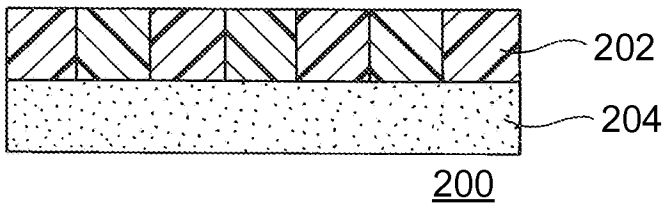

Fig. 2b

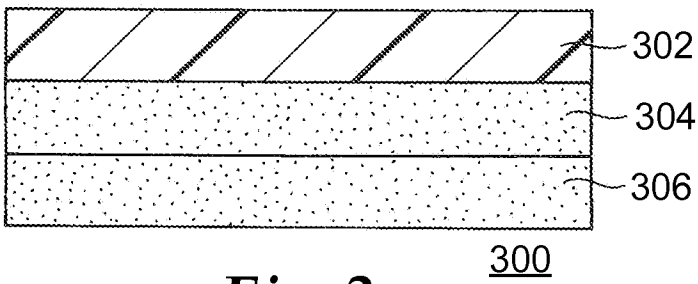

Fig. 3

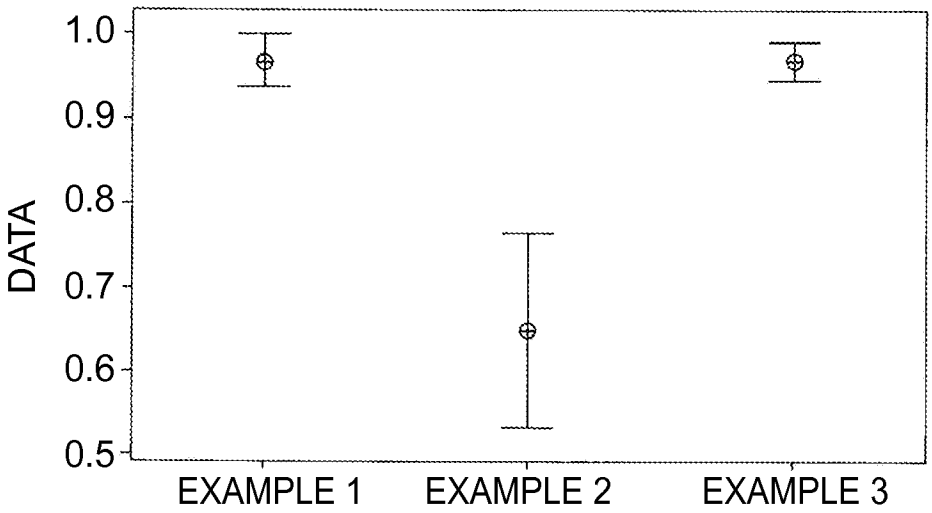
1.0
0.9
0.8
0.7
0.6
0.5
DATA
EXAMPLE 1
EXAMPLE 2
EXAMPLE 3

Fig. 4

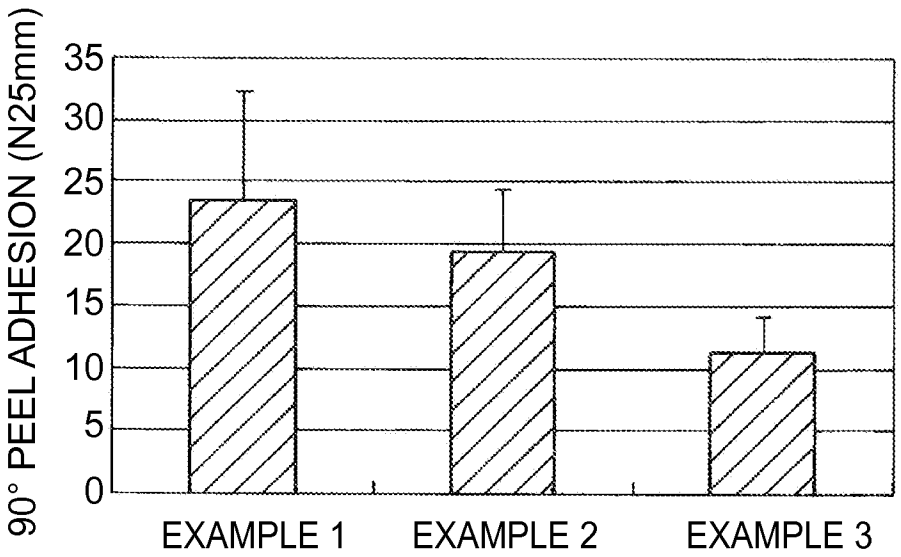
90° PEEL ADHESION (N25mm)
35
30
25
20
15
10
5
0
EXAMPLE 1
EXAMPLE 2
EXAMPLE 3

Fig. 5

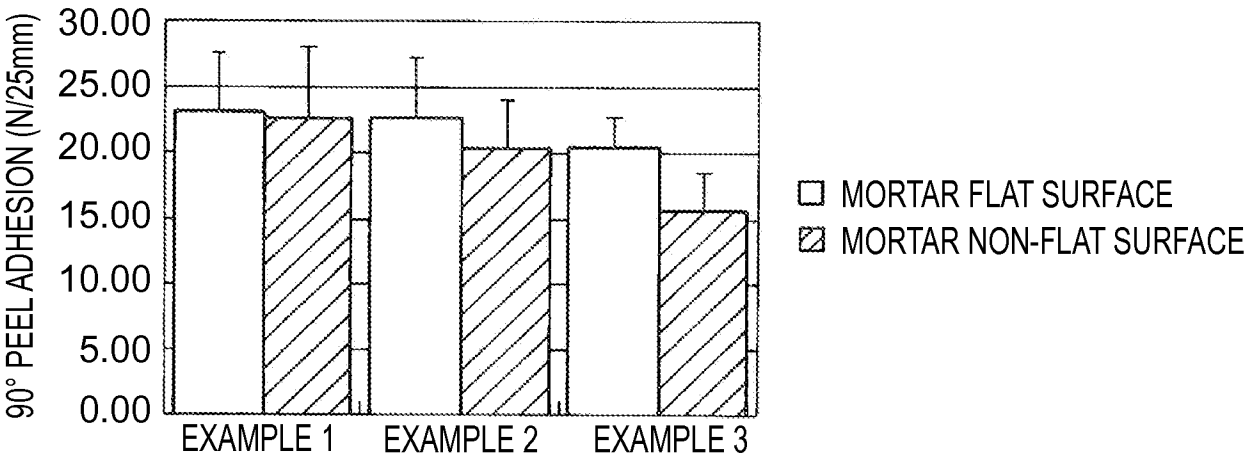

Fig. 6

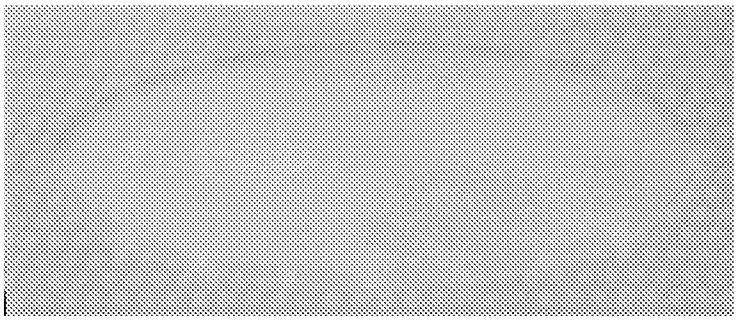

Fig. 7a

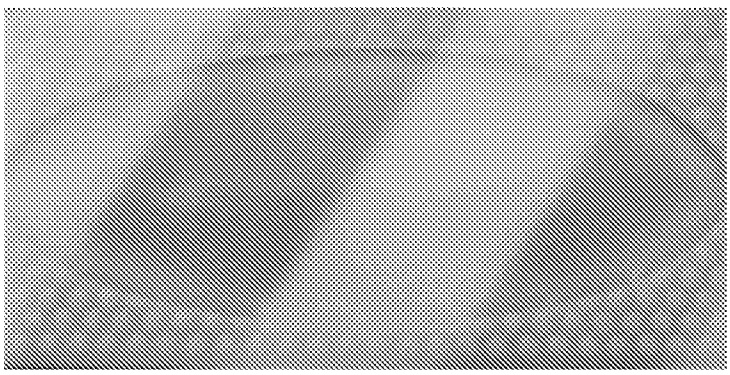

Fig. 7b

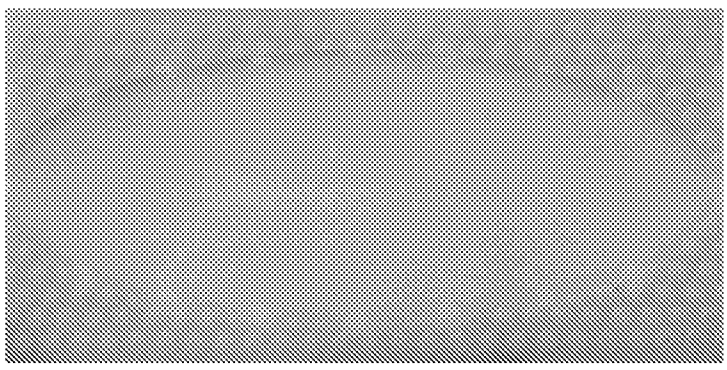

Fig. 7c