

DESCRIPTION

TITLE OF THE INVENTION: LAMINATE BODY

TECHNICAL FIELD

5 [0001]

The present invention relates to a novel laminate body. The laminate body of the present invention can be used, for example, as an architecture material applied to an outer wall surface or the like of an architectural structure.

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BACKGROUND ART

[0002]

Aesthetics are required for architecture materials used for exterior of an architectural structure from the viewpoint of scenic appearance. In recent years, as such an architecture material, those in which a natural stone, for example, is considered as an image or the like are attracting people's attention, and those having a comparatively large thickness and being imparted with a sense of dignity by various undulation patterns and the like are also adopted.

[0003]

Also, in urban areas in recent years, a climate peculiar to urban areas is being produced by artificial radiation heat or the like that is discharged from concrete

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buildings or cooling equipment. In particular, temperature rise outdoors in urban areas in summertime is considerable, thereby raising a problem referred to as heat-island phenomenon. To cope with such a problem, various materials for suppressing the temperature rise in the exterior surface of architectural structures are proposed.

[0004]

Under such a background, the patent document 1, for example, proposes a material in which a coating material containing a heat-shielding aggregate is applied on a base material. In this material, a heat-shielding aggregate in which a heat-reflecting pigment is allowed to adhere to the surface of the aggregate is adopted, whereby a temperature reduction effect is produced because the heat-reflecting pigment exhibits a near-infrared ray reflection function.

PRIOR ART DOCUMENT

PATENT DOCUMENT

[0005]

Patent Document 1: JP-A No. 2007-217586

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0006]

However, the surface of the material disclosed in the

patent document 1 has a fine undulation shape deriving from the aggregate, and a contaminant substance is liable to adhere to this recessed part. In particular, in urban areas, oily contaminant substances are floating in ambient
5 air due to exhaust gas from automobiles and the like, thereby giving a situation in which contamination is liable to proceed. Such a contaminant substance not only causes deterioration of aesthetics but also functions as a heat-accumulating field because the ability of absorbing
10 infrared ray in solar light is extremely high, thereby raising a fear of promoting temperature rise. Further, an excessive temperature rise deriving from such a contaminant substance may cause deterioration of the material.

[0007]

15 The present invention has been made in view of such problems, and an object thereof is to obtain a laminate body that not only has superior aesthetics but also can effectively suppress a temperature rise during solar light irradiation and can maintain that.

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MEANS FOR SOLVING THE PROBLEMS

[0008]

The present inventors and others have made eager studies in order to achieve the aforementioned object and,
25 as a result, have conceived of a laminate body in which a

decorative layer and a base layer are laminated, where the decorative layer contains specific colored particles and silica having a specific average particle size, thereby completing the present invention.

5 [0009]

In other words, the laminate body of the present invention is a laminate body in which a decorative layer and a base layer are laminated, wherein the decorative layer contains colored particles and silica having an
10 average primary particle size of 1 nm to 200 nm, and the colored particles are obtained by allowing a metal oxide to adhere to the surface of inorganic particles.

[0010]

In the laminate body of the present invention, it is
15 preferable that the decorative layer is a monolayer of a colored layer or a layer obtained by laminating a transparent layer on a colored layer; the colored layer contains a synthetic resin and the colored particles; and the transparent layer contains a synthetic resin.

20 [0011]

In the laminate body of the present invention, it is preferable that the colored layer contains 3 to 50 parts by weight of the synthetic resin relative to 100 parts by weight of the colored particles in a solid component
25 weight ratio.

[0012]

In the laminate body of the present invention, it is preferable that the monolayer of the colored layer contains 0.003 to 50 parts by weight of the silica relative to 100 parts by weight of the colored particles.

[0013]

In the laminate body of the present invention, it is preferable that the surface of the colored layer has a microscopic undulation shape deriving from the colored particles.

[0014]

In the laminate body of the present invention, it is preferable that the surface of the colored layer further has a macroscopic undulation pattern.

[0015]

In the laminate body of the present invention, it is preferable that the transparent layer contains 5 to 500 parts by weight of the synthetic resin relative to 100 parts by weight of the silica in a solid component weight ratio.

[0016]

A construction method of the present invention preferably bonds the above-described laminate body onto a base material via an adhesive agent.

[0017]

More specifically, the laminate body of the present invention has the following characteristics.

[0018]

The laminate body of the present invention is a
5 laminate body in which a colored layer is laminated on a
base layer, wherein the colored layer contains 3 to 50
parts by weight of a synthetic resin emulsion in a solid
component weight ratio and 0.003 to 50 parts by weight of
water-dispersible silica having an average primary particle
10 size of 1 to 200 nm in a solid component weight ratio
relative to 100 parts by weight of colored particles; the
surface of the layer has a microscopic undulation shape
deriving from the colored particles; and the colored
particles are obtained by allowing a metal oxide to adhere
15 to the surface of inorganic particles.

[0019]

The laminate body of the present invention is a
laminate body in which a colored layer is laminated on a
base layer, wherein the colored layer contains 3 to 50
20 parts by weight of a synthetic resin emulsion in a solid
component weight ratio and 0.003 to 50 parts by weight of
water-dispersible silica having an average primary particle
size of 1 to 200 nm in a solid component weight ratio
relative to 100 parts by weight of colored particles; the
25 surface of the layer has a microscopic undulation shape

deriving from the colored particles and has a macroscopic undulation pattern; and the colored particles are obtained by allowing a metal oxide to adhere to the surface of inorganic particles.

5 [0020]

Also, the laminate body of the present invention is a laminate body in which a transparent layer is laminated on a colored layer, wherein the colored layer contains 3 to 50 parts by weight of a synthetic resin in a solid component weight ratio relative to 100 parts by weight of colored particles; the surface of the layer has a microscopic undulation shape deriving from the colored particles; the colored particles are obtained by allowing a metal oxide to adhere to the surface of inorganic particles; and the transparent layer contains 5 to 500 parts by weight of a synthetic resin in a solid component weight ratio relative to 100 parts by weight of silica having an average primary particle size of 1 to 200 nm.

[0021]

20 The laminate body of the present invention is a laminate body in which a transparent layer is laminated on a colored layer, wherein the colored layer contains 3 to 50 parts by weight of a synthetic resin in a solid component weight ratio relative to 100 parts by weight of colored particles; the surface of the layer has a microscopic

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undulation shape deriving from the colored particles and has a macroscopic undulation pattern; the colored particles are obtained by allowing a metal oxide to adhere to the surface of inorganic particles; and the transparent layer
5 contains 5 to 500 parts by weight of a synthetic resin in a solid component weight ratio relative to 100 parts by weight of silica having an average primary particle size of 1 to 200 nm.

10 EFFECT OF THE INVENTION

[0022]

The laminate body of the present invention is a laminate body in which a colored layer containing specific colored particles and specific silica is laminated on a
15 base layer, and is imparted with aesthetics by color hue of the colored layer. Further, by synergistic function of infrared ray reflection property, contamination prevention property, and the like of the colored layer, the temperature rise during solar light irradiation is
20 effectively suppressed. Further, by contamination prevention function of the colored layer, the surface of the colored layer can be maintained to have aesthetics based on the color hue and the like of the colored layer for a long period of time, and also temperature rise caused
25 by adhesion of contaminant substances can be avoided for a

long period of time.

[0023]

Also, the laminate body of the present invention has a transparent layer containing specific silica on a colored layer containing specific colored particles. In the present invention, the laminate body is imparted with aesthetics by the color hue of the colored layer. Further, by synergistic function of infrared ray reflection property of the colored layer, contamination prevention property of the transparent layer, and the like, the temperature rise during solar light irradiation is effectively suppressed. In addition to such a function, in the present invention, temperature rise of the transparent layer is also suppressed by the infrared ray reflection function of the colored layer. When the temperature of the transparent layer rises excessively, there is a fear that an inherent contamination prevention function may not be exhibited by softening of the synthetic resin contained in the transparent layer, or the contamination prevention function may be deteriorated at an early stage by decrease in the durability. In contrast, in the present invention, the temperature rise of the transparent layer is suppressed by the function of the colored layer, and a sufficient contamination prevention effect is exhibited for a long period of time. By this, aesthetics based on the color hue

and the like of the colored layer can be maintained for a long period of time, and also the temperature rise caused by adhesion of contaminant substances can be avoided for a long period of time.

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MODES FOR CARRYING OUT THE INVENTION

[0024]

Hereafter, modes for carrying out the present invention will be described.

10 [0025]

The laminate body of the present invention is a laminate body in which a decorative layer and a base layer are laminated, wherein the decorative layer contains colored particles and silica having an average primary
15 particle size of 1 nm to 200 nm, and the colored particles are obtained by allowing a metal oxide to adhere to the surface of inorganic particles.

[0026]

Also, in the laminate body of the present invention,
20 it is preferable that the decorative layer is a monolayer of a colored layer or a layer obtained by laminating a transparent layer on a colored layer; the colored layer contains a synthetic resin and the colored particles; and the transparent layer contains a synthetic resin. In
25 particular, when the decorative layer is a monolayer of a

colored layer, it is preferable that the colored layer contains a synthetic resin, colored particles, and silica having an average primary particle size of 1 nm to 200 nm. When the decorative layer is a layer obtained by laminating
5 a transparent layer on a colored layer, it is preferable that the colored layer contains a synthetic resin and colored particles, and the transparent layer contains a synthetic resin and silica having an average primary particle size of 1 nm to 200 nm.

10 [0027]

When the decorative layer in the present invention contains specific colored particles, the laminate body can be imparted with design property and infrared ray reflection prevention property, and further, when the
15 decorative layer contains specific silica, the laminate body can be imparted with contamination prevention property, thereby providing a preferable mode.

[0028]

The (A) colored particles (hereafter also referred to
20 as "(A) component") in the present invention is obtained by allowing a (a2) metal oxide (hereafter also referred to as "(a2) component") to adhere to the surface of (a1) inorganic particles (hereafter also referred to as "(a1) component"). With regard to this (A) component, unlike the
25 case in which a general coloring pigment or the like having

a small average particle size is used, the small spots of the (A) component are visually recognized as varied hue patterns, thereby imparting an excellent color tone or material quality. Also, the (A) component forms a

5 microscopic undulation on the surface of the colored layer, thereby also contributing to imparting a three-dimensional design.

[0029]

The (a1) component constituting the (A) component such
10 as this is not particularly limited as long as the material thereof is inorganic, so that either of natural products and artificial products can be used. Specifically, crushed products of mica, kaolin, clay, argil, china clay, talc, aluminum hydroxide, magnesium hydroxide, calcium carbonate,
15 seashells, barite powder, marble, Mikage granite, serpentine, granite, fluorite, calcite, feldspar, silica stone, silica sand, and the like, crushed products of pottery and porcelain, crushed products of ceramics, glass beads, crushed products of glass, metals, and the like can
20 be raised as examples.

[0030]

The (a2) component that is allowed to adhere to the surface of the above-described (a1) component colors the surface of the (a1) component. As the (a2) component, for
25 example, a metal oxide containing at least one kind of a

metal element selected from transition metal elements such as scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, and copper; rare earth elements such as holmium, praseodymium, neodymium, and erbium; noble metal
5 elements such as gold, platinum, silver, palladium, and rhodium, or a composite oxide of these metal oxides can be used. As the composite oxide, a composite oxide of at least one kind selected from the above metal oxides and at least one kind of oxide selected from oxides of metal such
10 as silicon, aluminum, zirconium, zinc, lead, antimony, and tin; oxides of alkali earth metal such as magnesium, calcium, strontium, and barium; and inorganic oxides such as boron and phosphorus can be raised as an example.

[0031]

15 By containing the above (a2) component, the (A) component can maintain the color tone excellent in aesthetics for a long period of time and can exhibit an excellent infrared ray reflection function.

[0032]

20 It is sufficient that, in the (A) component of the present invention, the above (a2) component is allowed to adhere to the surface of the above (a1) component. At this time, it may be either one such that the above (a1) component and the above (a2) component adhere to each other
25 directly or one such that the above (a1) component and the

above (a2) component adhere to each other via a binder component. As the binder component, known binders such as organic, inorganic, and organic-inorganic-composite ones can be used. In particular, in the present invention, an
5 inorganic binder containing one or more kinds selected from silicate, aluminum salt, phosphate, and others is preferable.

[0033]

It is preferable that the (A) component contains
10 colored particles having an average particle size of 22 to 600 μm . In particular, in the present invention, it is preferable that the (A) component contains 10 wt% or more of colored particles (A1) having an average particle size of 22 μm or more and less than 150 μm . The ratio of the
15 above colored particles (A1) in the (A) component is more preferably 10 to 80 wt%, still more preferably 20 to 70 wt%, and most preferably 30 to 60 wt%.

Also, it is preferable that the (A) component contains 10 to 45 wt% of colored particles (A2) having an average
20 particle size of 150 μm or more and less than 212 μm . The ratio of the above colored particles (A2) in the (A) component is more preferably 15 to 40 wt% and still more preferably 20 to 35 wt%.

Further, it is preferable that the (A) component
25 contains 10 to 45 wt% of colored particles (A3) having an

average particle size of 212 μm or more and less than 600 μm . The ratio of the above colored particles (A3) in the (A) component is more preferably 15 to 40 wt% and still more preferably 20 to 35 wt%.

5 [0034]

The (A) component having such a particle size distribution can be obtained by combining at least two or more kinds, preferably three or more kinds, of colored particles having different average particle sizes. As a
10 preferable mode, a combination of colored particles having an average particle size of 53 μm or more and less than 125 μm and colored particles having an average particle size of 125 μm or more and less than 500 μm can be raised as an example. As a more preferable mode, a combination of
15 colored particles having an average particle size of 53 μm or more and less than 125 μm , colored particles having an average particle size of 125 μm or more and less than 212 μm , and colored particles having an average particle size of 212 μm or more and less than 500 μm can be raised as an
20 example. Here, the average particle size of the (A) component is a value obtained by sieving with a net sieve made of metal as defined in JIS Z8801-1:2000 and calculating an average value of the weight distribution thereof.

25 [0035]

In the present invention, the particle size construction of the (A) component such as described above can further enhance the aesthetic property and is also advantageous in suppressing the temperature rise,
5 preventing the deterioration (preventing the swelling and the like), and the like of the laminate body. This function mechanism is not definite; however, it is conjectured that the (A) component is densely aggregated in the colored layer to provide a mode in which the gaps
10 between the (A) components with each other are decreased, resulting in the functions such as described below.

- The function of diffusing and reflecting light near the surface of the colored layer is enhanced.

- The degree of undulation on the surface of the
15 colored layer is alleviated, whereby the contaminant substances constituting the source of accumulating heat become further less likely to adhere.

- By heat conductivity of the (A) component, the heat diffusion function of the colored layer is enhanced,
20 thereby to suppress a local temperature rise.

[0036]

The (B) synthetic resin (hereafter also referred to as "(B) component") in the colored layer plays a role of immobilizing the above (A) component.

25 [0037]

As the (B) component such as this, acrylic resin, silicone resin, acrylsilicone resin, fluororesin, vinyl acetate resin, acryl vinyl acetate resin, vinyl chloride resin, urethane resin, acrylurethane resin, epoxy resin, 5 alkyd resin, polyvinyl alcohol resin, polyester resin, ethylene resin, polyvinyl alcohol, cellulose, derivatives thereof, and others can be raised as examples. As a mode of the (B) component, water-dispersion type (synthetic resin emulsion), water-soluble type, nonaqueous dispersion 10 type, solvent-soluble type, non-solvent type, and others can be raised as examples, and these may be any of one-liquid type, two-liquid type, and others.

[0038]

The glass transition temperature of the (B) component 15 is preferably -60°C to 60°C , more preferably -40°C to 30°C , and still more preferably -30°C to 20°C . When the glass transition temperature of the (B) component is within such a range, a suitable flexibility can be imparted. Also, in the present invention, even when a synthetic resin having a 20 comparatively low glass transition temperature is used as the (B) component, a sufficient contamination prevention effect is obtained by a function of the transparent layer. Here, the glass transition temperature is a value obtained by the calculation formula of Fox.

25 [0039]

The ratio of the (B) component is typically 3 parts by weight or more and 50 parts by weight or less, preferably 4 parts by weight or more and 30 parts by weight or less, more preferably 5 parts by weight or more and less than 20 parts by weight, and still more preferably 6 parts by weight or more and 19 parts by weight or less, relative to 100 parts by weight of the (A) component as converted in terms of solid components. With such a ratio, a design property making use of the material quality of the (A) component can be imparted, and also the temperature rise can be effectively suppressed. Also, since the colored layer has a sufficient water vapor permeation property, the swelling and the like of the colored layer can be prevented.

[0040]

Also, the (B) synthetic resin (hereafter also referred to as (B) component) in the colored layer plays a role of immobilizing the above (A) component. In particular, in the present invention, it is preferable to use a synthetic resin emulsion as the (B) component. The (B) component such as this can be obtained, for example, by copolymerizing various polymerizable monomers. As the polymerizable monomer components constituting the (B) component, (meth)acrylic acid esters such as methyl (meth)acrylate, ethyl (meth)acrylate, isopropyl (meth)acrylate, n-butyl (meth)acrylate, isobutyl

(meth)acrylate, n-amyl (meth)acrylate, isoamyl
(meth)acrylate, n-hexyl (meth)acrylate, 2-ethylhexyl
(meth)acrylate, octyl (meth)acrylate, decyl (meth)acrylate,
dodecyl (meth)acrylate, octadecyl (meth)acrylate,
5 cyclohexyl (meth)acrylate, phenyl (meth)acrylate, and
benzyl (meth)acrylate; carboxyl-containing monomers such as
acrylic acid, methacrylic acid, crotonic acid, maleic acid
or monoalkyl ester thereof, itaconic acid or monoalkyl
ester thereof, and fumaric acid or monoalkyl ester thereof;
10 amino-containing monomers such as N-methylaminoethyl
(meth)acrylate, dimethylaminoethyl (meth)acrylate,
dimethylaminoethyl vinyl ether, N-(2-
dimethylaminoethyl)acrylamide, and N-(2-
dimethylaminoethyl)methacrylamide; pyridine-based monomers
15 such as vinylpyridine; hydroxyl-containing monomers such as
2-hydroxyethyl (meth)acrylate and hydroxypropyl
(meth)acrylate; vinyl ester-based monomers such as vinyl
acetate and vinyl propionate; nitrile-containing monomers
such as acrylonitrile and methacrylonitrile; aromatic
20 monomers such as styrene, 2-methylstyrene, vinyltoluene, t-
butylstyrene, chlorostyrene, vinylanisole, vinylnaphthalene,
and divinylbenzene; amide-containing monomers such as
acrylamide, methacrylamide, maleic acid amide, N-
methylol(meth)acrylamide, and diacetoneacrylamide; epoxy-
25 containing monomers such as glycidyl (meth)acrylate,

diglycidyl (meth)acrylate, and allyl glycidyl ether;
carbonyl-containing monomers such as acrolein,
diacetone(meth)acrylamide, vinyl methyl ketone, vinyl ethyl
ketone, and vinyl butyl ketone; alkoxysilyl-containing
5 monomers such as vinyltrimethoxysilane,
vinyltriethoxysilane, γ -
(meth)acryloyloxypropyltrimethoxysilane, γ -
(meth)acryloyloxypropyltriethoxysilane, and γ -
(meth)acryloyloxypropylmethyldimethoxysilane; halogenated
10 vinylidene-based monomers such as vinylidene chloride and
vinylidene fluoride; and, besides these, ethylene,
propylene, isoprene, butadiene, vinylpyrrolidone, vinyl
chloride, vinyl ether, vinyl ketone, vinylamide,
chloroprene, and others can be raised as examples. These
15 can be used as one kind or as two or more kinds. Among
these, when an alkoxysilyl-containing monomer is contained
as the polymerizable monomer, an improvement in the
physical property of the coating film can be achieved by
mutual action with a later-mentioned (D) component (silica
20 having an average primary particle size of 1 to 200 nm).
[0041]

The minimum film-forming temperature of the (B)
component can be suitably set, and the temperature is
typically 80°C or less, preferably 50°C or less, and further
25 preferably 30°C or less. When the minimum film-forming

temperature of the (B) component is within such a range, anti-contamination property can be exhibited while ensuring the physical property of the coating film such as anti-cracking property.

5 [0042]

A method of producing the (B) component is not particularly limited, and, for example, a synthetic resin emulsion, emulsion polymerization, soap-free emulsion polymerization, dispersion polymerization, feed emulsion
10 polymerization, feed dispersion polymerization, seed emulsion polymerization, seed dispersion polymerization, and others can be adopted.

[0043]

The average particle size of the (B) component is
15 typically about 0.05 to 0.3 μm . The solid component ratio in the total amount of the (B) component is not particularly limited, and the ratio is typically about 10 to 60 wt%.

[0044]

20 In the present invention, when the (B) component is a synthetic resin emulsion, a cross-linking reaction type synthetic resin emulsion, a core-shell type synthetic resin emulsion, and the like can be used as well. Also, two or more kinds of synthetic resin emulsions can be used in
25 combination. Among these, as the cross-linking reaction in

the cross-linking reaction type synthetic resin emulsion,
combinations of carboxyl and metal ion, carboxyl and
carbodiimide, carboxyl and epoxy, carboxyl and aziridine,
carboxyl and oxazoline, hydroxyl and isocyanate, carbonyl
5 and hydrazide, epoxy and hydrazide, epoxy and amino,
hydrolyzable silyls with each other, and the like can be
raised as examples. As a suitable cross-linking reaction
among these, combinations of carboxyl and epoxy, carboxyl
and oxazoline, carbonyl and hydrazide, epoxy and hydrazide,
10 hydrolyzable silyls with each other, and the like can be
raised as examples.

[0045]

Also, it is preferable that the (B) component is one
capable of reacting with the later-described (D) component
15 (silica having an average primary particle size of 1 to 200
nm). The (B) component is preferably, for example, a
synthetic resin having a functional group of hydroxyl,
hydrolyzable silyl, or the like (preferably hydrolyzable
silyl) that can react with a silanol group that is present
20 in the (D) component. In particular, when the (B)
component is a synthetic resin emulsion, the (D) component
is preferably a water-dispersible silica having an average
primary particle size of 1 to 200 nm. By chemical bond of
the (B) component and the (D) component, the anti-
25 contamination property can be exhibited while ensuring the

physical property of the coating film such as the anti-cracking property.

[0046]

The (D) component in the present invention is a silica
5 having an average primary particle size of 1 to 200 nm and
is preferably a water-dispersible silica. The particles
constituting the (D) component have a high hardness because
of containing silica as a major component, and are compound
having a silanol group on the surface of the particles.
10 The (D) component such as this contributes greatly to the
effect of improving the anti-contamination property.

[0047]

The average primary particle size of the (D) component
is typically 1 to 200 nm, preferably 3 to 100 nm, more
15 preferably 5 to 60 nm, and still more preferably 20 to 40
nm, as a primary particle size. When the average primary
particle size is too large, there is a fear of giving
adverse effects on the outer appearance of the formed
coating film. When the average primary particle size is
20 too small, there is a fear that a sufficient effect may not
be obtained in the anti-contamination property. In the
present invention, it is also possible to use two or more
kinds of silica having different average primary particle
sizes. Here, the particle size of the (D) component is a
25 value measured by the light scattering method.

[0048]

The pH of the (D) component is typically pH 5 or more and 12 or less, preferably 6 or more and 10 or less, and more preferably 6 or more and 9 or less. The (D) component
5 adjusted to have such a pH value can exhibit a hydrophilic property by abundant silanol groups on the particle surface thereof, thereby greatly contributing to improvement of the anti-contamination property.

[0049]

10 The (D) component such as this can be produced, for example, by using sodium silicate, lithium silicate, potassium silicate, or a silicate compound as a raw material. Among these, the silicate compound may be, for example, tetramethoxysilane, tetraethoxysilane, tetra-n-
15 propoxysilane, tetraisopropoxysilane, tetra-n-butoxysilane, tetraisobutoxysilane, tetra-sec-butoxysilane, tetra-t-butoxysilane, tetraphenoxysilane, or the like, or a condensate of these. Besides these, alkoxysilane compounds other than the above silicate compounds, alcohols, glycols,
20 glycol ethers, fluorine alcohols, silane coupling agents, polyoxyalkylene-containing compounds, and the like can be used in combination. At the time of production, a catalyst or the like can be used as well. Also, during the production process or after the production, the metals
25 contained in the catalyst or the like can be removed by an

ion-exchange process or the like.

[0050]

As a medium of the (D) component, water and/or a water-soluble solvent can be used. As the water-soluble solvent, alcohols, glycols, glycol ethers, and the like can be raised as examples. In the present invention, in particular, it is desirable that the medium is made only of water. By using the (D) component such as this, the covering material can be made to contain a low volatile organic solvent (low VOC). Also, generation of aggregate when it is mixed with the (B) component (preferably a synthetic resin emulsion) can be suppressed.

[0051]

The solid component of the (D) component is typically 5 to 60 wt%, preferably 10 to 55 wt%, and more preferably 15 to 50 wt%. When the solid component of the (D) component is within such a range, the stability of the (D) component itself and further the stability when the (B) component (preferably a synthetic resin emulsion) and the (D) component are mixed, can be ensured. When the solid component is too large in content, there is a fear that the (D) component itself may be destabilized or the covering material may be destabilized when mixed with the (B) component. When the solid component is too small in content, a large amount of the (D) component must be mixed

in order to obtain a sufficient anti-contamination property,
so that it is not so practical.

[0052]

The mixing ratio of the (A) component and the (B)
5 component is preferably such that the ratio of the (B)
component is typically 3 parts by weight or more and 50
parts by weight or less, more preferably 4 parts by weight
or more and 30 parts by weight or less, still more
preferably 5 parts by weight or more and less than 20 parts
10 by weight, and most preferably 6 parts by weight or more
and 19 parts by weight or less, relative to 100 parts by
weight of the (A) component as converted in terms of solid
components. Also, the mixing ratio of the (A) component
and the (D) component is such that the ratio of the (D)
15 component is typically 0.003 part by weight or more and 50
parts by weight or less, preferably 0.01 part by weight or
more and 30 parts by weight or less, relative to 100 parts
by weight of the (A) component as converted in terms of
solid components. With such a mixing ratio, a design
20 property making use of the material quality of the (A)
component is imparted, and also the temperature rise can be
effectively suppressed. Also, since the colored layer has
a sufficient water vapor permeation property, swelling of
the colored layer and the like can be prevented.

25 [0053]

In the colored layer, a (C) light stabilizer (hereafter also referred to as (C) component) can be used in addition to the above components. When the colored layer contains the (C) component such as this, an excellent
5 close adhesion property to a later-described transparent layer can be maintained for a long period of time, whereby the effect of the present invention can be sufficiently exhibited.

[0054]

10 As the (C) component such as this, a hindered amine-based light stabilizer can be raised as an example. Specifically, bis(2,2,6,6-tetramethyl-4-piperidyl) sebacate, bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate, bis(1-octoxy-2,2,6,6-tetramethyl-4-piperidyl) sebacate,
15 bis(1,2,2,6,6-pentamethyl-4-piperidyl) 2-(3,5-di-t-butyl-4-hydroxybenzyl)-2-n-butylmalonate, tetrakis(2,2,6,6-tetramethyl-4-piperidyl)-1,2,3,4-butanetetracarboxylate, tetrakis(1,2,2,6,6-pentamethyl-4-piperidyl)-1,2,3,4-butanetetracarboxylate, and others can be raised as
20 examples.

[0055]

The ratio of the (C) component is preferably 0.01 to 10 parts by weight, more preferably 0.05 to 5 parts by weight, more preferably 0.1 to 3 parts by weight, relative
25 to 100 parts by weight of the (A) component.

[0056]

Further, in the colored layer, glass powder of less than 1 μm can also be used, in addition to the above components, to such a degree that the effect of the present invention is not deteriorated. When the colored layer contains glass powder of less than 1 μm such as this, the temperature rise during the solar light irradiation can be more effectively suppressed.

[0057]

For the purpose of improving the design property and the like, the colored layer of the present invention can contain various colored or colorless particles other than the above components. As such particles, a coloring pigment, a glittering pigment, a fluorescent pigment, an extender, an aggregate, and others can be raised as examples. Also, the colored layer can contain other components in accordance with the needs as long as the effects of the present invention are not considerably deteriorated. As such a component, a plasticizer, an antialgal agent, an antibacterial agent, a eodorant, an adsorber, a flame retardant, a fiber, an ultraviolet absorber, a light stabilizer, an antioxidant, a catalyst, and others can be raised as examples.

[0058]

The colored layer of the present invention preferably

has a microscopic undulation shape deriving from the above (A) component on the surface thereof. This microscopic undulation is caused by the average particle size or degree of aggregation of the (A) component and preferably has a height difference of 1.5 mm or less (more preferably 0.005 mm or more and 1.2 mm or less, still more preferably 0.01 mm or more and 1 mm or less, and most preferably 0.02 mm or more and 0.8 mm or less).

[0059]

10 As the colored layer of the present invention, one further having a macroscopic undulation pattern in addition to the above-described microscopic undulation can be used. In the present invention, a particularly advantageous effect is obtained when the colored layer is in such a mode.

15 The macroscopic undulation pattern imparts a sense of three-dimensional appearance to the colored layer. This macroscopic undulation pattern is larger than the above-described microscopic undulation and preferably has a height difference of 1 mm or more and 10 mm (more preferably 1.5 mm or more and 8 mm or less). As an undulation pattern having such a height difference, an orange peel pattern, a ripple pattern, a stucco pattern, a sand wall pattern, a stone material pattern, a rock surface pattern, a sandstone pattern, a blown-off pattern, a moon surface pattern, a comb-swept pattern, a worm-eaten pattern,

20

25

and others can be raised as examples.

[0060]

The thickness of the colored layer may be suitably set in accordance with the object, and the thickness is preferably 0.5 mm to 10 mm, more preferably 1 mm to 8 mm. Such a range is advantageous in forming a sharply sculpted undulation pattern (macroscopic undulation pattern), and an excellent design property providing a sense of three-dimensional appearance is easily obtained.

10 [0061]

In the laminate body of the present invention, a transparent layer may be provided on the uppermost surface. The transparent layer is such that (E) silica having an average primary particle size of 1 to 200 nm (hereafter also referred to as "(E) component") is immobilized by a (F) synthetic resin (hereafter also referred to as "(F) component").

[0062]

With respect to the (E) component in the transparent layer, the hardness of the particles themselves is high, and also the particle surface has a lot of silanol groups, whereby an excellent contamination prevention effect is exhibited.

[0063]

25 The average primary particle size of the (E) component

is typically 1 to 200 nm, preferably 3 to 100 nm, and more preferably 5 to 60 nm. Within this range, a plurality of silica having different average primary particle sizes can be used in combination. When the average primary particle
5 size of the (E) component is larger than 200 nm, the specific surface area will be smaller, and the silanol groups also decrease in amount, so that the contamination prevention property will be insufficient. When the average primary particle size of the (E) component is smaller than
10 1 nm, the silica itself is destabilized, so that it is not practical. Here, the average primary particle size as referred to herein is a value measured by the light scattering method.

[0064]

15 The (E) component such as this is preferably derived from silica sol, and further more preferably derived from water-dispersible silica sol having a pH value of 5 or more and 12 or less (preferably 6 or more and 10 or less, and more preferably 6 or more and 9 or less).

20 [0065]

The water-dispersible silica sol such as this can be produced, for example, by using sodium silicate, lithium silicate, potassium silicate, or a silicate compound as a raw material. Among these, the silicate compound may be,
25 for example, tetramethoxysilane, tetraethoxysilane, tetra-

n-propoxysilane, tetraisopropoxysilane, tetra-n-butoxysilane, tetraisobutoxysilane, tetra-sec-butoxysilane, tetra-t-butoxysilane, tetraphenoxysilane, or the like, or a condensate of these. Besides these, alkoxysilane compounds
5 other than the above silicate compounds, alcohols, glycols, glycol ethers, fluorine alcohols, silane coupling agents, polyoxyalkylene-containing compounds, and the like can be used in combination.

[0066]

10 As the (F) component immobilizing the above (E) component, various resins can be used. Specifically, those similar to the above (B) component can be raised as examples, and one kind or two or more kinds of these can be used. The resin such as this is preferably a water-soluble
15 resin and/or a water-dispersible resin.

[0067]

The ratio of the (F) component is typically 5 to 500 parts by weight, preferably 10 to 100 parts by weight, and more preferably 20 to 80 parts by weight, relative to 100
20 parts by weight of the solid component of the (E) component. With such a ratio, the close adhesion property to the colored layer is excellent and a sufficient contamination prevention effect is obtained. Also, this is advantageous in suppressing the temperature rise. Moreover, such an
25 effect is exhibited for a long period of time. Also, the

water vapor permeation property of the colored layer is not inhibited, so that it is advantageous also in preventing swelling and the like. It seems that, by the heat diffusion function based on the heat conduction property of
5 the (E) component, local temperature rise is also suppressed.

[0068]

Further, in the transparent layer, glass powder of less than 1 μm can also be used, in addition to the above
10 components, to such a degree that the effect of the present invention is not deteriorated. When the transparent layer contains glass powder of less than 1 μm such as this, the temperature rise during the solar light irradiation can be more effectively suppressed.

15 [0069]

In addition to the (E) component and the (F) component described above, the transparent layer of the present invention can contain other components in accordance with the needs to such a degree that the effect of the present
20 invention is not deteriorated. As such a component, a plasticizer, an antialgal agent, an antibacterial agent, a deodorant, an adsorber, a flame retardant, a fiber, an ultraviolet absorber, a light stabilizer, an antioxidant, a catalyst, a glittering pigment, a fluorescent pigment, and
25 others can be raised as examples.

[0070]

It is sufficient that the transparent layer is in a mode of covering the whole surface of the colored layer. The weight of the transparent layer per unit area is preferably 0.1 to 50 g/m², more preferably 0.5 to 20 g/m², as converted in terms of solid components. The transparent layer such as this can cover the whole of the colored layer including the surface of individual colored particles, the proximity of the colored particles, the gaps between the colored particles, and others in the upper part of the colored layer.

[0071]

In the present invention, the transparent layer can be in a mode of being disproportionately present in the recessed part of the microscopic undulation shape. With such a mode, the effects of preventing the contamination, suppressing the temperature rise, and the like can be further enhanced without inhibiting the aesthetics of the colored layer. Moreover, the effects can be exhibited for a long period of time. The functional mechanism thereof is not definite; however, it is inferred that the following points are involved.

The undulation on the surface of the colored layer is alleviated, so that the adhesion of contaminant substances and the like is suppressed.

The interface between the colored particles and the synthetic resin on the surface of the colored layer is reinforced.

In the recessed part, the film thickness is large, making it less liable to receive the influence of corrosion and the like.

[0072]

(Base layer)

In the present invention, a base layer can be laminated, for example, in the inside or on the back surface of the colored layer as long as the effects of the present invention are not inhibited. The material used in the base layer preferably has a flexibility, water vapor permeation property, and the like. As such a material, fibrous materials such as woven cloth, non-woven cloth, mesh, and cloth can be raised as examples. Specifically, as the fibrous material, those containing an inorganic fiber having a thickness of 0.05 to 1.5 mm (more preferably 0.1 to 1.2 mm and still more preferably 0.2 to 1 mm) and a basis weight of 5 to 300 g/m² (more preferably 10 to 250 g/m² and still more preferably 20 to 200 g/m²), and the like can be raised as examples. Further, the fibrous material is preferably subjected to a covering treatment with a processing liquid containing a silicon compound, whereby the flexibility can be further improved. By using such a

fibrous material, the anti-cracking property of the laminate body and the like can be enhanced. Also, the laminate body can be stably supported when the laminate body is implemented for constructing an outer wall surface
5 and the like.

[0073]

(Method of producing the laminate body)

In the present invention, the production method thereof is not particularly limited as long as the
10 aforementioned transparent layer is laminated on the aforementioned colored layer; however, it is preferable to adopt a method of forming a transparent layer on a colored layer after the colored layer is formed, in particular, as the following (1) or (2). By this method, the transparent
15 layer covers the whole surface of the colored layer, and also a mode of being disproportionately present in the recessed part of the microscopic undulation shape is more easily obtained, so that it is suitable also in view of exhibiting the effect of the present invention. Here, in
20 the following (2), a laminate body is obtained in which a colored layer and a transparent layer are successively laminated on a base layer.

[0074]

Also, in the present invention, the production method
25 is not particularly limited as long as the aforementioned

colored layer is laminated on the aforementioned base layer,
and the methods of the following (3) and (4) and the like
can be raised as examples, and in particular, a production
method of forming the colored layer on the base layer such
5 as in the following (4) is preferable. By this method, the
whole of the uppermost surface of the colored layer is
covered with a thin film containing the (B) component and
the (D) component, and it is easy to obtain a mode in which
the thin film is disproportionately present in the recessed
10 part of the microscopic undulation shape, so that it is
suitable also in view of exhibiting the effect of the
present invention.

[0075]

(1) A method of applying a composition for a colored
15 layer containing (A) colored particles and (B) synthetic
resin on a releasing underlayer thereby to form the colored
layer, thereafter applying a composition for a transparent
layer containing (E) silica and (F) synthetic resin thereby
to form the transparent layer, removing the releasing
20 underlayer after curing, and thereafter laminating a base
layer with an adhesive agent or the like.

(2) A method of applying a composition for a colored
layer containing (A) colored particles and (B) synthetic
resin on a base layer thereby to form the colored layer,
25 and thereafter applying a composition for a transparent

layer containing (E) silica and (F) synthetic resin thereby to form the transparent layer.

(3) A method of applying a composition for a colored layer containing the (A) component, the (B) component, and
5 the (D) component on a releasing underlayer thereby to form the colored layer, thereafter laminating a base layer, and removing the releasing underlayer after curing.

(4) A method of applying a composition for a colored layer containing the (A) component, the (B) component, and
10 the (D) component on a base layer thereby to form the colored layer.

[0076]

It is sufficient that the releasing underlayer in the above (1) and (3) is one capable of being removed after
15 curing, so that a mold frame made of silicone resin, urethane resin, metal, or the like, or a releasing paper or the like can be used, for example.

Also, in the above (1) to (4), it is preferable that the releasing underlayer or the base layer is horizontally
20 placed, and the composition for the colored layer and the composition for the transparent layer are laminated thereon.

[0077]

In the above (1) to (4), the composition for the colored layer and the composition for the transparent layer
25 can contain known additives in accordance with the needs as

long as the effects of the present invention are not considerably deteriorated. Such an additive may be, for example, a thickening agent, a film-forming auxiliary agent, a leveling agent, a wetting agent, a plasticizer, an
5 antifreezing agent, a pH adjusting agent, an antiseptic agent, an antifungal agent, an antialgal agent, an antibacterial agent, a deodorant, a dispersant, a defoaming agent, an absorber, a flame retardant, a coloring pigment, an extender, a fiber, a water-repellent agent, a cross-
10 linking agent, an ultraviolet absorber, an antioxidant, a catalyst, or the like.

[0078]

In the above (1) to (4), in applying the composition for the colored layer, a known application tool such as a
15 spray, a roller, a trowel, a reciprocator, a coater, or pouring can be used, for example. In applying the composition for the transparent layer, a known application tool such as a spray or a roller can be used, for example.

[0079]

20 In the above (1) to (4), drying of the composition for the colored layer and drying of the composition for the transparent layer may be carried out separately from each other or may be simultaneously carried out by applying the composition for the transparent layer in a state in which
25 the composition for the colored layer is not yet dried.

The drying can be carried out at an ordinary temperature in the present invention, and heating is preferably carried out. The heating temperature is preferably about 40°C or higher and lower than 170°C.

5 [0080]

As a method for forming a macroscopic undulation pattern in the colored layer, the following methods can be adopted, for example.

(i) Application in a pattern is carried out in
10 applying the composition for the colored layer.

(ii) After the composition for the colored layer is uniformly applied, a part thereof is removed or pressed in a state of not being cured yet.

(iii) After the composition for the colored layer is
15 cured, the surface thereof is partially cut and removed.

[0081]

In the above (i), various undulation patterns are obtained by suitably selecting the kind of application tool and the method of using it or by adjusting the viscosity of
20 the composition for the colored layer.

In the above (ii), various undulation patterns are obtained by performing a removing or pressing treatment on the application surface with use of a tool such as a design roller, a trowel, a brush, a comb, a spatula, a stamp, or
25 an embossing device before the composition for the colored

layer is dried.

In the above (iii), a grinding tool, a cutting tool, or the like can be used.

[0082]

5 Among these, in the present invention, the method of the above (i) and/or (ii) is preferable.

In particular, in the above (i), a method of applying by accelerating a ball-shaped substance of the composition for the colored layer is preferable. Such a method may be,
10 for example, a method of spraying the composition for the colored layer in a ball shape by using a centrifugal force, an air pressure, or the like.

Also, in the above (ii), a method of pressing the application surface of the composition for the colored
15 layer is preferable. Such a method may be, for example, a method of performing an embossing treatment on the application surface after the composition for the colored layer is applied.

By such a method, the (A) component is liable to be
20 densely aggregated, so that the effect of the present invention is easily obtained. Also, a thin film containing the (B) component and the (D) component is liable to be formed on the uppermost surface of the colored layer, so that the effect of the present invention is easily obtained.

25 [0083]

<Method of implementing the laminate body for construction>

The laminate body of the present invention can be applied mainly as an exterior architectural material of an architectural structure. In other words, in implementing
5 the laminate body of the present invention for construction, the laminate body may be bonded onto an exterior surface (underlayer) of the architectural structure which is a base material. Such a base material (underlayer) may be, for example, concrete, mortar, fiber-mingled cement plate,
10 cement calcium silicate plate, slag cement pearlite plate, plaster board, tile, ALC plate, siding plate, extrusion-molded plate, steel plate, plastic plate, wooden plate, or the like. These underlayers may be one treated with a filler, a putty, a sealer, or the like.

15 [0084]

In bonding the laminate body of the present invention onto a base material (underlayer), an adhesive agent, a pressure-sensitive adhesive agent, a pressure-sensitive adhesive tape, a peg, a nail, or the like may be used, for
20 example. Besides these, immobilization can be carried out using a pin, a fastener, a rail, or the like. Among these, it is preferable to bond to the base material (underlayer) via an adhesive agent. Because of having a suitable water vapor permeation property, the laminate body of the present
25 invention exhibits an effect of promoting the drying

property of the adhesive agent when bonded to the base material (underlayer) via the adhesive agent.

[0085]

Also, in bonding the laminate body with the adhesive agent, the laminate body may be bonded by allowing adjacent laminate bodies to abut against each other, or a masonry joint may be provided by bonding the laminate bodies at a predetermined interval. In the present invention, a joint part can be easily formed by bonding the laminate bodies so that the adhesive agent may be exposed between the laminate bodies. In this case, the interval of bonding the laminate bodies (joint width) may be preferably about 1 to 30 mm. Such a range gives a decoration finish making use of the joint pattern. The adhesive agent of the joint part may be subjected to a smoothening treatment using a spatula or the like in accordance with the needs. Here, the atmosphere temperature at the time of curing the adhesive agent can be suitably set, and the temperature may typically be an ordinary temperature.

20

EXAMPLES

[0086]

Hereafter, Examples will be shown to make the characteristic features of the present invention more definite.

25

[0087]

(Compositions I-1 to I-9 for colored layer)

In accordance with the blending shown in Table 1, the raw materials were mixed and stirred by an ordinary method
5 to produce the compositions I-1 to I-9 for a colored layer. Here, as the raw materials, the following materials were used.

[0088]

· Colored particles 1: black particles (having an
10 average particle size of 90 μm) obtained by allowing a composite oxide (manganese oxide · cobalt oxide · iron oxide) to adhere to the surface of silica stone

· Colored particles 2: black particles (having an
average particle size of 160 μm) obtained by allowing a
15 composite oxide (manganese oxide · cobalt oxide · iron oxide) to adhere to the surface of silica stone

· Colored particles 3: black particles (having an
average particle size of 300 μm) obtained by allowing a
composite oxide (manganese oxide · cobalt oxide · iron
20 oxide) to adhere to the surface of silica stone

· Colored particles 4: brown particles (having an
average particle size of 80 μm) obtained by allowing a
metal oxide containing iron oxide to adhere to the surface
of silica stone

25 · Colored particles 5: brown particles (having an

average particle size of 170 μm) obtained by allowing a metal oxide containing iron oxide to adhere to the surface of silica stone

· Colored particles 6: brown particles (having an
5 average particle size of 280 μm) obtained by allowing a metal oxide containing iron oxide to adhere to the surface of silica stone

· Colored particles 7: white particles (having an
average particle size of 95 μm) obtained by allowing a
10 metal oxide containing titanium oxide to adhere to the surface of silica stone

· Colored particles 8: white particles (having an
average particle size of 140 μm) obtained by allowing a
metal oxide containing titanium oxide to adhere to the
15 surface of silica stone

· Colored particles 9: white particles (having an
average particle size of 350 μm) obtained by allowing a
metal oxide containing titanium oxide to adhere to the
surface of silica stone
20 · Synthetic resin 1 (acrylic resin emulsion, solid component occupying 50 wt%, glass transition temperature of 0°C)

· Light stabilizer (bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate)

25 [0089]

Here, in the colored particles of the composition I-5 for a colored layer, the colored particles (A1) having an average particle size of 22 μm or more and less than 150 μm occupied 40 wt%; the colored particles (A2) having an
5 average particle size of 150 μm or more and less than 212 μm occupied 30 wt%; and the colored particles (A3) having an average particle size of 212 μm or more and less than 600 μm occupied 30 wt%.

In the colored particles of the composition I-6 for a
10 colored layer, (A1) occupied 45 wt%; (A2) occupied 31 wt%; and (A3) occupied 24 wt%.

In the colored particles of the composition I-7 for a colored layer, (A1) occupied 52 wt%; (A2) occupied 22 wt%; and (A3) occupied 26 wt%.

15 The compositions I-8 and I-9 for a colored layer were similar to the composition I-5 for a colored layer.

[0090]

(Composition for transparent layer)

As the composition for a transparent layer, the
20 following one was prepared.

[0091]

· Composition 1 for a transparent layer

Water dispersion liquid in which silica (water-dispersible silica sol, pH 7.6, average primary particle
25 size of 27 nm) : acrylsilicone polymer (methyl methacrylate

- n-butyl acrylate - 2-ethylhexyl acrylate - γ -methacryloyloxypropyltrimethoxysilane copolymer resin, glass transition temperature of 18°C) = 100 : 60 (solid component weight ratio).

5 [0092]

· Composition 2 for a transparent layer

Water dispersion liquid in which silica (water-dispersible silica sol, pH 7.3, average primary particle size of 43 nm) : acrylsilicone polymer (methyl methacrylate

10 - n-butyl acrylate - 2-ethylhexyl acrylate - γ -methacryloyloxypropyltrimethoxysilane copolymer resin, glass transition temperature of 18°C) = 100 : 38 (solid component weight ratio).

[0093]

15 · Composition 3 for a transparent layer

Water dispersion liquid in which silica (water-dispersible silica sol, pH 7.8, average primary particle size of 12 nm) : acrylsilicone polymer (methyl methacrylate

- n-butyl acrylate - 2-ethylhexyl acrylate - γ -methacryloyloxypropyltrimethoxysilane copolymer resin,
20 glass transition temperature of 18°C) = 100 : 72 (solid component weight ratio).

[0094]

· Composition 4 for a transparent layer

25 Water dispersion liquid in which silica (water-

dispersible silica sol, pH 7.6, average primary particle size of 27 nm) : acrylsilicone polymer (methyl methacrylate - n-butyl acrylate - 2-ethylhexyl acrylate - γ -methacryloyloxypropyltrimethoxysilane copolymer resin, 5 glass transition temperature of 18°C) = 100 : 320 (solid component weight ratio).

[0095]

· Composition 5 for a transparent layer

Water dispersion liquid of acrylsilicone polymer
10 (methyl methacrylate - n-butyl acrylate - 2-ethylhexyl acrylate - γ -methacryloyloxypropyltrimethoxysilane copolymer resin, glass transition temperature of 18°C).

[0096]

(Test example I-1)

15 The composition I-1 for a colored layer was applied onto a base layer (glass non-woven cloth: thickness of 0.4 mm, basis weight of 50 g/m²) with a coater so as to attain a dry thickness of 2 mm and dried at 60°C for 60 minutes. Subsequently, the composition 1 for a transparent layer was
20 applied by spraying so that the solid component weight after drying would be 5 g/m², and thereafter dried at 80°C for 60 minutes to obtain a laminate body I-1. The height difference of the microscopic undulation in the colored layer was 0.2 mm.

25 The following test was carried out on the obtained

laminate body I-1. The result is shown in Table 2.

[0097]

(Test method)

The laminate body obtained by the above-described
5 method was immersed into a contaminant substance suspension
(concentration of 1 wt%) for two hours and, after being
pulled up and left to stand in a standard state for 24
hours, washed with water and dried. The laminate body
subjected to the above process was irradiated with an
10 infrared lamp from a distance of 50 cm, and the back
surface temperature of the test body when the temperature
rise reached an equilibrium was measured to evaluate the
temperature rise suppression property. The evaluation was
such that the one with a temperature of less than 55.0°C
15 was marked with "A"; the one with a temperature of 55.0°C
or more and less than 57.5°C was marked with "A'"; the one
with a temperature of 57.5°C or more and less than 60.0°C
was marked with "B"; the one with a temperature of 60.0°C
or more and less than 62.5°C was marked with "B'"; the one
20 with a temperature of 62.5°C or more and less than 65.0°C
was marked with "C"; and the one with a temperature of
65.0°C or more was marked with "C'".

[0098]

(Test examples I-2 to I-5)

25 Laminate bodies I-2 to I-5 were fabricated by a method

similar to that of the test example I-1 except that the composition I-1 for a colored layer was replaced with the compositions I-2 to I-5 for a colored layer, respectively (the height difference of the microscopic undulation in the colored layer was 0.2 mm).

A test similar to that of the test example I-1 was carried out on the obtained laminate bodies. The result is shown in Table 2.

[0099]

(Test examples I-6 to I-7)

Laminate bodies I-6 to I-7 were fabricated by a method similar to that of the test example I-1 except that the composition 1 for a transparent layer was replaced with the compositions 2 to 3 for a transparent layer, respectively (the height difference of the microscopic undulation in the colored layer was 0.2 mm).

A test similar to that of the test example I-1 was carried out on the obtained laminate bodies. The result is shown in Table 2.

[0100]

(Test example I-8)

The composition I-5 for a colored layer was applied onto a base layer (glass non-woven cloth: thickness of 0.4 mm, basis weight of 50 g/m²) with a coater so as to attain a dry thickness of 4 mm and dried at 60°C for 10 minutes.

Thereafter, an embossing treatment was carried out to form an undulation pattern having a sandstone tone (height difference of 3 mm) on the surface (the height difference of the microscopic undulation was 0.1 mm). Subsequently, 5 the composition 1 for a transparent layer was applied by spraying so that the solid component weight after drying would be 5 g/m^2 , and thereafter dried at 80°C for 60 minutes to obtain a laminate body I-8.

A test similar to that of the test example I-1 was 10 carried out on the obtained laminate body I-8. The result is shown in Table 2.

[0101]

(Test example I-9)

A laminate body I-9 was fabricated by a method similar 15 to that of the test example I-8 except that the composition I-5 for a colored layer was replaced with the composition I-8 for a colored layer (the height difference of the undulation pattern was 3 mm, the height difference of the microscopic undulation was 0.1 mm).

20 A test similar to that of the test example I-1 was carried out on the obtained laminate body I-9. The result is shown in Table 2.

[0102]

(Test example I-10)

25 The composition 5 for a colored layer was sprayed in a

ball shape onto a base layer (glass non-woven cloth:
thickness of 0.4 mm, basis weight of 50 g/m²) using air
pressure so as to form an undulation pattern (height
difference of 2 mm) having a dry thickness of 1 to 3 mm and
5 dried at 60°C for 60 minutes (the height difference of the
microscopic undulation was 0.1 mm). Subsequently, the
composition 1 for a transparent layer was applied by
spraying so that the solid component weight after drying
would be 5 g/m², and thereafter dried at 80°C for 60 minutes
10 to obtain a laminate body I-10.

A test similar to that of the test example I-1 was
carried out on the obtained laminate body I-10. The result
is shown in Table 2.

[0103]

15 (Test example I-11)

A laminate body I-11 was fabricated by a method
similar to that of the test example I-10 except that the
composition I-5 for a colored layer was replaced with the
composition I-9 for a colored layer (the height difference
20 of the undulation pattern was 2 mm, the height difference
of the microscopic undulation was 0.1 mm).

A test similar to that of the test example I-1 was
carried out on the obtained laminate body I-11. The result
is shown in Table 2.

25 [0104]

(Test example I-12)

A laminate body I-12 was fabricated by a method similar to that of the test example I-10 except that the composition 1 for a transparent layer was replaced with the
5 composition 4 for a transparent layer (the height difference of the undulation pattern was 2 mm, the height difference of the microscopic undulation was 0.1 mm).

A test similar to that of the test example I-1 was carried out on the obtained laminate body I-12. The result
10 is shown in Table 2.

[0105]

(Test example I-13)

The compositions I-5, I-6, I-7 for a colored layer were sprayed respectively in a ball shape onto a base layer
15 (glass non-woven cloth: thickness of 0.4 mm, basis weight of 50 g/m²) using air pressure so as to form an undulation pattern (height difference of 2 mm) having a dry thickness of 1 to 3 mm and dried at 60°C for 60 minutes (the height difference of the microscopic undulation was 0.1 mm).
20 Subsequently, the composition 1 for a transparent layer was applied by spraying so that the solid component weight after drying would be 5 g/m², and thereafter dried at 80°C for 60 minutes to obtain a laminate body I-13.

A test similar to that of the test example I-1 was
25 carried out on the obtained laminate body I-13. The result

is shown in Table 2.

[0106]

(Test example I-14)

The composition I-1 for a colored layer was applied
5 onto a base layer (glass non-woven cloth: thickness of 0.4
mm, basis weight of 50 g/m²) with a coater so as to attain
a dry thickness of 2 mm and, after being dried at 60°C for
60 minutes, further dried at 80°C for 60 minutes to obtain
a laminate body I-14 (the microscopic height difference of
10 the undulation in the colored layer was 0.2 mm).

A test similar to that of the test example I-1 was
carried out on the obtained laminate body I-14. The result
is shown in Table 2.

[0107]

15 (Test example I-15)

A laminate body I-15 was fabricated by a method
similar to that of the test example I-1 except that the
composition 1 for a transparent layer was replaced with the
composition 5 for a transparent layer (the microscopic
20 height difference of the undulation in the colored layer
was 0.2 mm). A test similar to that of the test example I-
1 was carried out on the obtained laminate body I-15. The
result is shown in Table 2.

[0108]

25 (Test example I-16)

The laminate body I-10 and the laminate body I-11 described above were exposed for 1200 hours by an accelerated weathering tester, and thereafter a test similar to that of the test example I-1 was carried out.

- 5 As a result thereof, the laminate body I-10 after the exposure was evaluated as "B", and the laminate body I-11 after the exposure was evaluated as "A".

[0109]

[Table 1]

contents of blending	composition for colored layer								
	I-1	I-2	I-3	I-4	I-5	I-6	I-7	I-8	I-9
colored particles 1	-	-	-	-	18	-	-	18	18
colored particles 2	100	100	-	-	52	-	-	52	52
colored particles 3	-	-	-	-	30	-	-	30	30
colored particles 4	-	-	-	-	-	30	-	-	-
colored particles 5	-	-	100	-	-	50	-	-	-
colored particles 6	-	-	-	-	-	20	-	-	-
colored particles 7	-	-	-	-	-	-	37	-	-
colored particles 8	-	-	-	100	-	-	43	-	-
colored particles 9	-	-	-	-	-	-	20	-	-
synthetic resin 1	16	32	16	16	16	16	16	12	16
light stabilizer	-	-	-	-	-	-	-	-	0.4

[0110]

[Table 2]

laminate body	test examples														
	I-1	I-2	I-3	I-4	I-5	I-6	I-7	I-8	I-9	I-10	I-11	I-12	I-13	I-14	I-15
colored layer	1	2	3	4	5	5	5	5	8	5	9	5	5,6,7	1	1
transparent layer	1	1	1	1	1	2	3	1	1	1	1	4	1	-	5
evaluation	B	B'	B	B	A'	A'	A'	A	A	A	A	A'	A	C'	C'

[0111]

(Compositions II-1 to II-10 for colored layer)

In accordance with the blending shown in Table 3, the raw materials were mixed and stirred by an ordinary method to produce the compositions II-1 to II-10 for a colored layer. As the raw materials, the following materials were used. Here, as the colored particles, the above-mentioned colored particles 1 to 9 were used.

[0112]

10 · Synthetic resin emulsion 1: acrylic resin emulsion (methyl methacrylate - cyclohexyl methacrylate - (2-ethylhexyl acrylate) - methacrylic acid copolymer, pH 8.7, solid component occupying 50 wt%, glass transition temperature of 15°C, minimum film-forming temperature of 19°C)

 · Synthetic resin emulsion 2: acrylic resin emulsion (methyl methacrylate - (n-butyl acrylate) - (2-ethylhexyl acrylate) - (γ -methacryloyloxypropyltrimethoxysilane) - methacrylic acid copolymer, pH 8.9, solid component occupying 50 wt%, glass transition temperature of 23°C, minimum film-forming temperature of 25°C)

 · Water-dispersible silica 1: silica sol (pH 7.6, solid component occupying 20 wt%, average primary particle size of 27 nm)

25 · Water-dispersible silica 2: silica sol (pH 9.3,

solid component occupying 20 wt%, average primary particle size of 20 nm)

Water-dispersible silica 3: silica sol (pH 9.5, solid component occupying 40 wt%, average primary particle size of 20 nm)

[0113]

Here, in the colored particles of the composition II-5 for a colored layer, the colored particles (A1) having an average particle size of 22 μm or more and less than 150 μm occupied 40 wt%; the colored particles (A2) having an average particle size of 150 μm or more and less than 212 μm occupied 30 wt%; and the colored particles (A3) having an average particle size of 212 μm or more and less than 600 μm occupied 30 wt%.

In the colored particles of the composition II-7 for a colored layer, (A1) occupied 45 wt%; (A2) occupied 31 wt%; and (A3) occupied 24 wt%.

In the colored particles of the composition II-8 for a colored layer, (A1) occupied 52 wt%; (A2) occupied 22 wt%; and (A3) occupied 26 wt%.

The compositions II-6, II-9, and II-10 for a colored layer were similar to the composition II-5 for a colored layer.

[0114]

(Test example II-1)

The composition II-1 for a colored layer was applied onto a base layer A (glass non-woven cloth: thickness of 0.4 mm, basis weight of 50 g/m²) with a coater so as to attain a dry thickness of 2 mm and dried at 60°C for 60 minutes to obtain a laminate body II-1. The height difference of the microscopic undulation in the colored layer was 0.2 mm.

The following test was carried out on the obtained laminate body II-1. The result is shown in Table 4.

10 [0115]

(Infrared ray reflectivity test)

The laminate body obtained by the above-described method was immersed into a contaminant substance suspension (concentration of 1 wt%) for two hours and, after being pulled up and left to stand in a standard state for 24 hours, washed with water and dried. The laminate body subjected to the above process was irradiated with an infrared lamp from a distance of 50 cm, and the back surface temperature of the test body when the temperature rise reached an equilibrium was measured to evaluate the temperature rise suppression property. The evaluation was such that the one with a temperature of less than 55.0°C was marked with "A"; the one with a temperature of 55.0°C or more and less than 57.5°C was marked with "A'"; the one with a temperature of 57.5°C or more and less than 60.0°C

was marked with "B"; the one with a temperature of 60.0°C or more and less than 62.5°C was marked with "B'"; the one with a temperature of 62.5°C or more and less than 65.0°C was marked with "C"; and the one with a temperature of
5 65.0°C or more was marked with "C'".

[0116]

(Test examples II-2 to II-5)

Laminate bodies II-2 to II-5 were fabricated by a method similar to that of the test example 1 except that
10 the composition II-1 for a colored layer was replaced with the compositions 2 to 5 for a colored layer, respectively (the height difference of the microscopic undulation in the colored layer was 0.2 mm).

A test similar to that of the test example II-1 was
15 carried out on the obtained laminate bodies. The result is shown in Table 4.

[0117]

(Test example II-6)

The composition II-5 for a colored layer was applied
20 onto a base layer A with a coater so as to attain a dry thickness of 4 mm and dried at 60°C for 10 minutes. Thereafter, an embossing treatment was carried out to form an undulation pattern having a sandstone tone on the surface, thereby to fabricate a laminate body II-6 (height
25 difference of the undulation pattern was 3 mm, the height

difference of the microscopic undulation in the colored layer was 0.1 mm).

A test similar to that of the test example II-1 was carried out on the obtained laminate body II-6. The result
5 is shown in Table 4.

[0118]

(Test example II-7)

A laminate body II-7 was fabricated by a method similar to that of the test example II-6 except that the
10 composition II-5 for a colored layer was replaced with the composition II-6 for a colored layer (the height difference of the undulation pattern was 3 mm, the height difference of the microscopic undulation was 0.1 mm).

A test similar to that of the test example II-1 was
15 carried out on the obtained laminate body II-7. The result is shown in Table 4.

[0119]

(Test example II-8)

A laminate body II-8 was fabricated by a method
20 similar to that of the test example II-6 except that the composition II-5 for a colored layer was replaced with the composition II-9 for a colored layer (the height difference of the undulation pattern was 3 mm, the height difference of the microscopic undulation was 0.1 mm).

25 A test similar to that of the test example 1 was

carried out on the obtained laminate body II-8. The result is shown in Table 4.

[0120]

(Test example II-9)

5 The composition II-5 for a colored layer was sprayed in a ball shape onto a base layer A using air pressure so as to form an undulation pattern (height difference of 2 mm) having a dry thickness of 1 to 3 mm and dried at 60°C for 60 minutes, thereby to fabricate a laminate body II-9
10 (the height difference of the microscopic undulation was 0.1 mm).

A test similar to that of the test example II-1 was carried out on the obtained laminate body II-9. The result is shown in Table 4.

15 [0121]

(Test example II-10)

The compositions II-5, II-7, II-8 for a colored layer were sprayed respectively in a ball shape onto a base layer A using air pressure so as to form an undulation pattern
20 (height difference of 2 mm) having a dry thickness of 1 to 3 mm and dried at 60°C for 60 minutes, thereby to fabricate a laminate body II-10 (the height difference of the microscopic undulation was 0.1 mm).

A test similar to that of the test example II-1 was
25 carried out on the obtained laminate body II-10. The

result is shown in Table 4.

[0122]

(Test example II-11)

A laminate body II-11 was fabricated by a method
5 similar to that of the test example II-1 except that the
composition II-1 for a colored layer was replaced with the
composition II-10 for a colored layer (the height
difference of the microscopic undulation in the colored
layer was 0.2 mm). A test similar to that of the test
10 example II-1 was carried out on the obtained laminate body
II-11. The result is shown in Table 4.

[0123]

[Table 3]

contents of blending	composition for colored layer									
	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-8	II-9	II-10
colored particles 1	-	-	-	-	18	18	-	-	18	-
colored particles 2	100	100	-	-	52	52	-	-	52	100
colored particles 3	-	-	-	-	30	30	-	-	30	-
colored particles 4	-	-	-	-	-	-	30	-	-	-
colored particles 5	-	-	100	-	-	-	50	-	-	-
colored particles 6	-	-	-	-	-	-	20	-	-	-
colored particles 7	-	-	-	-	-	-	-	37	-	-
colored particles 8	-	-	-	100	-	-	-	43	-	-
colored particles 9	-	-	-	-	-	-	-	20	-	-
synthetic resin emulsion 1	16	32	16	16	16	-	16	16	12	16
synthetic resin emulsion 2	-	-	-	-	-	16	-	-	-	-
water- dispersible silica 1	6	-	-	-	-	-	-	-	-	-
water- dispersible silica 2	-	4	-	-	-	-	-	-	-	-
water- dispersible silica 3	-	-	4	4	4	4	4	4	2.5	-

[0124]

[Table 4]

laminate body	test examples										
	II-1	II-2	II-3	II-4	II-5	II-6	II-7	II-8	II-9	II-10	II-11
colored layer	1	2	3	4	5	5	6	9	5	5,7,8	10
evaluation	B	B'	B	B	A'	A	A	A	A	A	C'

CLAIMS

1. A laminate body in which a decorative layer and a base layer are laminated,

5 wherein the decorative layer contains colored particles and silica having an average primary particle size of 1 nm to 200 nm, and

 the colored particles are obtained by allowing a metal oxide to adhere to the surface of inorganic particles,

10 wherein the decorative layer is a monolayer of a colored layer or a layer obtained by laminating a transparent layer on a colored layer,

 the colored layer contains a synthetic resin and the colored particles, and

15 the transparent layer contains a synthetic resin,

 wherein the colored layer contains 3 to 50 parts by weight of the synthetic resin relative to 100 parts by weight of the colored particles in a solid component weight ratio.

20

2. The laminate body according to claim 1, wherein the monolayer of the colored layer contains 0.003 to 50 parts by weight of the silica relative to 100 parts by weight of the colored particles.

25

3. The laminate body according to claim 1, wherein the surface of the colored layer has a microscopic undulation shape deriving from the colored particles.

4. The laminate body according to claim 1, wherein the surface of the colored layer further has a macroscopic undulation pattern.
- 5 5. The laminate body according to claim 1, wherein the transparent layer contains 5 to 500 parts by weight of the synthetic resin relative to 100 parts by weight of the silica in a solid component weight ratio.
- 10 6. A construction method by bonding a laminate body according to any one of claims 1 to 5 onto a base material via an adhesive agent.