

COMPOSITION, TRANSFER SHEET, MELAMINE DECORATIVE LAMINATE,
AND METHOD OF PRODUCING MELAMINE DECORATIVE LAMINATE

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This international application claims the benefit of Japanese Patent Application No. 2020-76030 filed on April 22, 2020 with the Japan Patent Office, the entire disclosure of which is incorporated herein by reference.

TECHNICAL FIELD

[0002] The present disclosure relates to a composition, a transfer sheet, a melamine decorative laminate, and a method of producing a melamine decorative laminate.

BACKGROUND ART

[0003] The melamine decorative laminate includes a melamine resin-containing patterned paper as a design layer. The melamine decorative laminate is obtained by applying heat and pressure, with a press machine, to the melamine resin-containing patterned paper and a core material such as a phenol resin-impregnated paper. The melamine decorative laminate is available in various finishes by changing patterns and/or color tones of the patterned paper.

[0004] The melamine decorative laminate described above is excellent in various properties such as surface hardness, heat resistance, and wear resistance. Thus, the melamine decorative laminate is widely used for furniture, such as counters and desks, and interior materials, such as wall surfaces and floors.

[0005] In recent years, there have been problems that the melamine decorative laminate easily makes fingerprint adhesion and oil stains noticeable. Furthermore, increase in airtightness of houses has caused a problem such as a concern about odors from daily life. Thus, a need has arisen for cleaner environment in public facilities, such as hospitals.

PRIOR ART DOCUMENTS

PATENT DOCUMENTS

[0006] Patent Document 1: Japanese Unexamined Patent Application Publication No. 2012-176515

Patent Document 2: Japanese Unexamined Patent Application Publication No. 2017-205928

Patent Document 3: Japanese Unexamined Patent Application Publication No. 2018-27694

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

[0007] The Applicant discloses a decorative laminate having anti-fingerprint performance and oil removal performance (Patent Document 1). In the composition in Patent Document 1, however, as it is difficult to uniformly disperse a substance to provide odor reduction performance, the odor reduction performance could not be sometimes obtained sufficiently. Furthermore, the Applicant discloses a decorative laminate with odor reduction performance that reduces odors from daily life and chemical odors (Patent Document 2). In the method in Patent Document 2, however, it is difficult to uniformly perform coating with a substance to provide antiviral performance or anti-allergen performance. Thus, the antiviral performance or the anti-allergen performance could not be sometimes obtained sufficiently.

MEANS FOR SOLVING THE PROBLEMS

[0008] One aspect of the present disclosure provides a composition including (A) a hydrolytic condensate of silicon alkoxide, (B) an organo silica sol dispersed in a hydrophilic solvent, and (C) an acrylic polymer having a hydrophilic group and a hydrophobic group.

[0009] One aspect of the present disclosure provides a transfer sheet including a sheet-like base material and a cured layer made of the aforementioned

composition. The cured layer is formed on one side surface of the sheet-like base material.

[0010] One aspect of the present disclosure provides a melamine decorative laminate including a core layer, a decorative layer, and a cured layer made of the aforementioned composition in this order. The decorative layer includes a cured product made of a melamine resin layer.

[0011] One aspect of the present disclosure provides a method of producing a melamine decorative laminate. The melamine decorative laminate includes a core layer, a decorative layer including a cured product made of melamine resin, and a front surface layer in this order. The method of producing a melamine decorative laminate includes curing the aforementioned composition to thereby form the front surface layer.

EFFECTS OF THE INVENTION

[0012] According to one aspect of the present disclosure, there is provided a composition that can uniformly disperse a substance to exhibit functionality (hereinafter, referred to as “function-exhibiting substance”) such as odor reduction performance, antiviral performance, and anti-allergen performance and that is excellent in the functionality.

[0013] Furthermore, according to one aspect of the present disclosure, there are provided a transfer sheet, a melamine decorative laminate, and a method of producing the melamine decorative laminate. The transfer sheet and the melamine decorative laminate include a cured product made of the aforementioned composition and have excellent functionality.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a cross-sectional view of a configuration of a melamine decorative laminate according to Example 1.

FIG. 2 is a cross-sectional view of a configuration a melamine decorative laminate according to Example 32.

FIG. 3 is a cross-sectional view of a configuration of a melamine decorative laminate according to Example 94.

EXPLANATION OF REFERENCE NUMERALS

[0015] 2...cured layer made of functional composition, 3...melamine resin-impregnated patterned paper, 4...prepreg, 5...phenol resin-impregnated core paper, 6...core layer, 7...backer, 8...melamine resin-impregnated overlay paper, 11...melamine decorative laminate, 12...melamine decorative laminate, 13...melamine decorative laminate

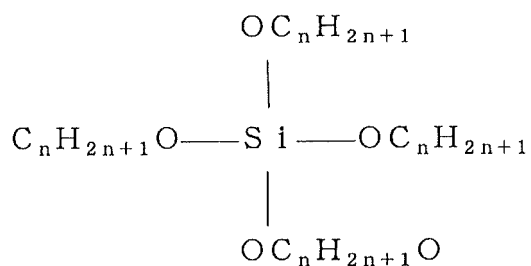
MODE FOR CARRYING OUT THE INVENTION

[0016] Hereinafter, the present disclosure will be described in details.

[0017] A hydrolytic condensate of silicon alkoxide (A) has a skeleton formed like a lattice. When the hydrolytic condensate of silicon alkoxide is blended with a function-exhibiting substance to be described later, the function-exhibiting substance is uniformly dispersed. The function-exhibiting substance exhibits its effect even when an amount of addition thereof is small. Specific examples of silicon alkoxide include those having a structure expressed by the following Chemical Formula 1 ("n" is an integer) and more specifically, tetramethyl orthosilicate ($\text{Si}(\text{OCH}_3)_4$), tetraethyl orthosilicate ($\text{Si}(\text{OC}_2\text{H}_5)_4$), and tetrapropyl orthosilicate ($\text{Si}(\text{OC}_3\text{H}_7)_4$). Silicon alkoxide is synthesized mainly through a reaction of silicon tetrachloride with alkyl alcohol or a reaction of metal silicon with alkyl alcohol.

<Chemical Formula 1>

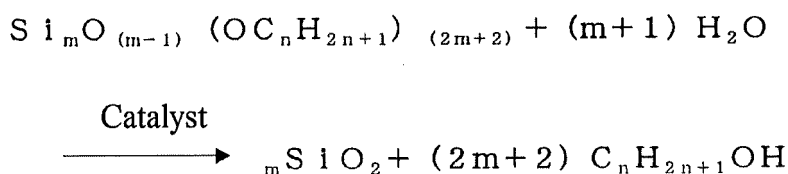
[0018] [Formula 1]



When silicon alkoxide and water are mixed for reaction, hydrolysis progresses in accordance with a reaction formula expressed by Chemical Formula 2 ("m" is an integer). For stabilizing a hydrolysis solution, methanol, ethanol, isopropanol, ethyl cellosolve, mixed alcohol, or the like is used as a solvent.

<Chemical Formula 2>

[0019] [Formula 2]



Example commercial products of the hydrolytic condensate of silicon alkoxide include "HAS-1" (SiO₂ content of 20.7 to 21.5% by mass, a mixed solvent of ethanol/isopropanol/methanol), "HAS-6" (SiO₂ content of 17.6 to 18.4% by mass, a mixed solvent of ethanol/methanol), and "HAS-10" (SiO₂ content of 10.0 to 10.4% by mass, a mixed solvent of ethanol/isopropanol/methanol) (the aforementioned are trade names and

manufactured by Colcoat Co., Ltd.).

[0020] There is provided an organo silica sol as a component (B). Examples of the organo silica sol include a colloid solution in which colloidal silica having an average particle diameter of 1 to 40 nm (more preferably, an average particle diameter of 7 to 30 nm) is stably dispersed in an organic solvent. A silica concentration is within a range of preferably 1 to 50% by mass, and more preferably 40% by mass or less in order to prevent gelling of the colloidal silica. It should be noted that the average particle diameter of the colloidal silica means a particle diameter at an integrated value of 50% in a particle size distribution obtained by a laser diffraction/scattering method.

[0021] Example commercial products of the organo silica sol include "IPA-ST", "IPA-ST-ZL", "methanol silica sol", "NPC-ST-30", "MEK-AC-2140Z", "EG-ST", and "DMAC-ST" manufactured by Nissan Chemical Corporation, "OSCAL" manufactured by JGC C&C, "Quartron (registered trademark)" manufactured by FUSO CHEMICAL CO., LTD., and "Highlink (registered trademark) OG silica organo sol" manufactured by Clariant (Japan) K.K.

[0022] The organo silica sol dispersed in an organic solvent, particularly in a hydrophilic solvent, has a sufficient content of hydroxyl group on a silica particle surface. The hydroxyl group on the silica particle surface adheres to melamine resin, thereby making a surface of a decorative laminate excellent in durability. The organo silica sol dispersed in a hydrophobic solvent has an insufficient content of the hydroxyl group on the silica surface. This is prone to degrade adhesiveness to a melamine resin layer.

[0023] The hydrophilic (polar) solvent is a solvent having an affinity for water. Examples of the hydrophilic solvent include a hydrophilic organic solvent having, in a molecule, a hydrophilic group, such as a hydroxyl group, a carboxyl group, and a carbonyl group. Examples of the hydrophilic (polar) solvent include a protic polar solvent and an aprotic polar solvent. Specific examples of the protic polar solvent include an alcohol-based solvent, such as methyl alcohol, ethyl alcohol, isopropanol, ethylene dialcohol, and propanol, and a

cellosolve-based solvent, such as methyl cellosolve, ethyl cellosolve, butyl cellosolve, and n-propyl cellosolve. Examples of the aprotic polar solvent include acetone, dimethyl sulfoxide (DMSO), N,N-dimethylformamide (DME), and pyridine.

[0024] There is provided an acrylic polymer as a component (C). The acrylic polymer is preferably a copolymer of: a monomer having a hydrophilic group to exhibit an affinity for pigment; and a monomer having a hydrophobic group to control compatibility and provide steric hindrance. Such an acrylic polymer enables the function-exhibiting substance to be uniformly dispersed due to the hydrophilic group adsorbing the function-exhibiting substance and the hydrophobic group suppressing aggregation of the function-exhibiting substance. The organo silica sol, which has a particle diameter of approximately 20 to 30 nm, forms an aggregation having a large particle diameter of 600 to 1000 nm when aggregating. Due to the organo silica sol being uniformly dispersed, light-scattering properties of a cured layer made of the functional composition is enhanced, thereby reducing a defect in appearance caused by interference of a light.

[0025] Examples of the hydrophilic group include an anionic group, such as a carboxyl group, a sulfonic acid group, and a phosphoric acid group, and a cationic group, such as an amino group and an ammonium group. Specific examples of the monomer having the hydrophilic group include acrylic acid, acrylamide, methacrylic acid, poly (ethylene glycol) acrylate and methacrylate, dimethylaminoethyl methacrylate, diethylaminoethyl methacrylate, t-butylaminoethyl methacrylate, dimethylaminoethyl acrylate, diethylaminoethyl acrylate, methacrylamide, dimethacrylamide, dimethylaminopropyl methacrylamide, ethylene glycol methacrylate phosphate, 2-(methacryloyloxy)methyl phthalate, 2-(methacryloyloxy)ethyl succinate, 3-sulfopropyl methacrylate, and 3-sulfopropyl acrylate.

[0026] Examples of the hydrophobic group include an alkyl group and a phenyl group.

Specifically, examples of the monomer having the hydrophobic group include methyl methacrylate, butyl methacrylate, hexyl acrylate, hexylethyl acrylate, benzyl acrylate, benzyl methacrylate, phenoxyethyl acrylate, phenoxyethyl methacrylate, and a mixture thereof.

[0027] In the composition described above, preferably 0.5 to 12 parts by mass, and more preferably 1 to 9 parts by mass of the organo silica sol of the component (B) is blended with respect to 1 part by mass (in terms of solid content) of the hydrolytic condensate of silicon alkoxide of the component (A). When a blending ratio of the component (A) is equal to or more than the lower limit, a function-exhibiting effect is improved. When the blending ratio of the component (A) is equal to or less than the upper limit, solvent resistance is improved.

[0028] Preferably 0.005 to 0.3 parts by mass, and more preferably 0.01 to 0.07 parts by mass (in terms of solid content) of the acrylic polymer of the component (C) having the hydrophilic group and the hydrophobic group is blended with respect to 1 part by mass (in terms of solid content) of the component (B). When a blending ratio of the component (C) exceeds the upper limit, aggregation properties of the colloidal silica increases. Thus, when the blending ratio of the component (C) is equal to or less than the upper limit, it is possible to reduce a defect in appearance caused by light interference in a low refractive index layer. Furthermore, when the blending ratio of the above component (C) is equal to or more than the lower limit, a blended solution has a suitable viscosity, thereby enabling formation of a uniform low refractive index layer. Accordingly, provided is a melamine decorative laminate that makes a fingerprint less noticeable and makes a pattern of a printed paper clearer.

[0029] The composition including (A) the hydrolytic condensate of silicon alkoxide, (B) the organo silica sol dispersed in the hydrophilic solvent, and (C) the acrylic polymer having the hydrophilic group and the hydrophobic group improves dispersibility of the function-exhibiting substance to be added. Specifically, the function-exhibiting substance enters into a lattice-like coating

structure of the component (A), thereby enabling uniform coating with the function-exhibiting substance. Furthermore, the function-exhibiting substance can efficiently exhibit the function even when the amount of addition is small. In particular, these effects can be easily obtained when the function-exhibiting substance contains a solid, specifically, a solid particle having an average particle diameter of 200 to 5000 nm. Here, the average particle diameter means a particle diameter at an integrated value of 50% in a particle size distribution obtained by a laser diffraction/scattering method.

[0030] The function-exhibiting substance is preferably at least one selected from a group consisting of an odor-reducing substance (m), an antiviral substance (n), and an anti-allergen substance (o). Preferably, the function-exhibiting substance is blended and stirred with and the above-described composition using a homogenizer at 6000 to 10000 rpm for 5 to 10 minutes. The homogenizer applies a pressure to composition and makes the composition subjected to a strong shear force when the composition passes through a slit (gap). When stirred with a dispersion blade, the function-exhibiting substance can be uniformly dispersed.

[0031] Next, a description is given to the odor-reducing substance (m) that exhibits the odor reduction performance as an example of the function-exhibiting substance. There is an odor-reducing substance of the physical adsorption type, for example, a porous material such as activate carbon. Such an odor-reducing substance makes an odor (gas) adsorbed by a pore of the porous material, to thereby exhibit an odor-reducing effect. Adsorption performance of the odor-reducing substance of the physical adsorption type is decreased when the odor-reducing substance of the physical adsorption type is subjected to a high-temperature heat or a heat such as frictional heat after gas adsorption at a normal temperature. Accordingly, there is a possibility that the gas adsorbed may be re-discharged.

[0032] On the other hand, an odor-reducing substance of the chemical adsorption type is a substance to eliminate an odor by converting the odor to another

substance through a chemical reaction, such as acid-alkali neutralization reaction and oxidization-reduction reaction. Once adsorbed and decomposed into another substance, the odor (gas) is not easily discharged again. Thus, the odor-reducing substance of the chemical adsorption type can be suitably used. Examples of the odor-reducing substance of the chemical adsorption type include metal oxides, such as silica (silicon dioxide), copper oxide, alumina, titanium oxide, zinc oxide, iron oxide, and zirconium oxide, and metal hydroxides, such as zirconium hydroxide, magnesium hydroxide, aluminum hydroxide, ferrous hydroxide, and copper hydroxide.

[0033] Regarding these odor-reducing substances (m) that achieves the odor reduction performance, it is preferred to use the odor-reducing substance of the chemical adsorption type described above. This is because the melamine decorative laminate, which is excellent in heat resistance and wear resistance, can also cope with odors from daily life generated inside a house, such as a combined odor of acidic, neutral, and basic odors. Modern houses have a structure emphasizing on higher air tightness and higher heat insulation, as compared to conventional houses, so that they are a space hermetically sealed with no gaps. Thus, the odors from daily life are more perceptible. To reduce such odors from daily life, it is typical to use odor eliminating products that are commercially available. However, as the melamine decorative laminate itself has the odor reduction performance, it is possible to further reduce the odors from daily life.

[0034] Specifically, the odor-reducing substance of the chemical adsorption type is preferably at least one selected from a group consisting of zinc oxide, silica, zeolite, copper oxide, and zirconium oxide. Preferably, zinc oxide and silica are combined as an example of metal oxide, and a blending ratio by mass of zinc oxide to silica is 45 to 85:55 to 15. Preferably, the odor-reducing substance is particularly in the form of a fine particle, and specifically have an average particle diameter of 0.2 to 10 μm . This is because such an odor-reducing substance has good dispersibility in the composition. Here, the average particle

diameter means a particle diameter at an integrated value of 50% in a particle size distribution obtained by a laser diffraction/scattering method. In particular, for the neutral odors such as acetaldehyde and formaldehyde, and basic odors such as ammonia trimethylamine, modified silica such as amino-modified silica is preferable due to a high odor-reducing effect. For sulfur gases such as hydrogen sulfide and mercaptan, and the acidic odors such as isovaleric acetate and butyric acid, zinc oxide is preferable due to a high odor-reducing effect. Still further, examples of zeolite may include a silver-containing zeolite substance (that is, zeolite containing silver).

[0035] It is preferred that a blending amount of the odor-reducing substance (m) in the composition is 30 to 60 parts by mass (in terms of solid content) with respect to 100 parts by mass in solid content of the composition. When the odor-reducing substance (m) is less than the lower limit, the odor-reducing effect is prone to be reduced. When the odor-reducing substance (m) exceeds the upper limit, unevenness due to blushing is prone to occur in a surface of the melamine decorative laminate. Here, the unevenness due to blushing means a state of the melamine decorative laminate in which a whitish haziness is generated in a part of the surface of the melamine decorative laminate.

[0036] Next, a description is given in details to the antiviral substance (n) that exhibits the antiviral performance as an example of the function-exhibiting substance. Examples of the antiviral substance include a photocatalyst, for which titanium oxide is mainly used. The photocatalyst produces active oxygen from an exciting light, to thereby inactivate a virus. Despite a principle to enable exhibition of an effect substantially permanently, the photocatalyst has a disadvantage of not being able to exhibit its performance without being irradiated with a light.

[0037] On the other hand, an organic antiviral substance destroys an outer wall membrane of protein of a virus. The virus, with the outer wall membrane destroyed, is inhibited to synthesize protein. Alternatively, the organic antiviral substance denatures protein and inactivates the virus. The organic

antiviral substance has a feature to exhibit its effect sooner than a photocatalyst-based antiviral substance.

[0038] The organic antiviral substance is preferably at least one selected from a group consisting of a triazine-imidazole-thiazole-based substance, amino-modified polyvinyl alcohol, and an amino-modified acrylic polymer. These organic antiviral substances are advantageous for the melamine decorative laminate, which is demanded to have solvent resistance and stain resistance. Preferably, the organic antiviral substance is particularly in the form of a fine particle, and specifically, at least one selected from a group consisting of a particle carrying the triazine-imidazole-thiazole-based substance thereon, an amino-modified polyvinyl alcohol particle, and an amino-modified acrylic polymer particle. An average particle diameter of the organic antiviral substance in the particulate form is preferably 0.5 to 3 μm due to favorable dispersibility thereof in the composition. Here, the average particle diameter means a particle diameter at an integrated value of 50% in a particle size distribution obtained by a laser diffraction/scattering method.

[0039] It is preferred that a blending amount of the antiviral substance (n) in the composition is 35 to 75 parts by mass (in terms of solid content) with respect to 100 parts by mass in solid content of the composition. When the blending amount of the antiviral substance (n) is less than the lower limit, an antiviral effect is prone to be reduced. When the blending amount of the antiviral substance (n) exceeds the upper limit, the unevenness due to blushing occurs in the surface of the melamine decorative laminate.

[0040] Next, a description is given in details to the anti-allergen substance (o) that exhibits anti-allergen performance as an example of the function-exhibiting substance. The air carries invisible dust that contains an allergen, such as cedar pollen, dead bodies and droppings of mites, etc. The allergen causes allergy. The anti-allergen substance (o) is preferably a composite of an anion-modified organic compound and a carrier. The composite undergoes chemisorption reaction with protein of the allergen to thereby exhibit an effect to reduce the

allergen.

[0041] The anion-modified organic compound, which is an element of the anti-allergen substance (o), alone exhibits the same effect to reduce the allergen. However, it is difficult for the anion-modified organic compound alone to be adhered to the surface of the melamine decorative laminate. This is prone to lack durability of the anti-allergen performance. Thus, it is preferred to include the anion-modified organic compound as a compound with a carrier, which is a solid component. As the composite with the carrier can be physically adhered to the surface of the melamine decorative laminate, such a composite is preferable particularly for the melamine decorative laminate that is demanded to have durability.

[0042] Examples of the anion-modified organic compound include anion-modified linear alkane and anion-modified polyvinyl alcohol. Specific examples of the anion-modified linear alkane include linear alkane modified by an acidic anion group, such as a carboxyl group, a phosphate group, and a sulfonic acid group. Examples of a counter ion of the acidic anion group include sodium ion and potassium ion. Examples of the anion-modified polyvinyl alcohol include polyvinyl alcohol modified by an acidic anion group, such as a carboxyl group and a sulfonic acid group. Furthermore, examples of the carrier include an inorganic particle or an organic particle, for example, acrylic particles, such as base-modified acrylic particles, styrene particles, such as base-modified styrene particles, and silver oxide particles. The carrier is preferably at least one selected from a group consisting of styrene particles and silver oxide. It is preferred that the anti-allergen substance (o) is particularly in the form of a fine particle, specifically with an average particle diameter of 1 to 8 μm . Here, the average particle diameter means a particle diameter at an integrated value of 50% in a particle size distribution obtained by a laser diffraction/scattering method.

[0043] It is preferred that a blending amount of the anti-allergen substance (o) in the composition is 3 to 50 parts by mass (in terms of solid content) with respect

to 100 parts by mass in solid content of the composition. When the blending amount of the anti-allergen substance (o) is less than the lower limit, an anti-allergen effect is prone to be reduced. When the blending amount of the anti-allergen substance (o) exceeds the upper limit, the unevenness due to blushing occurs in the surface of the melamine decorative laminate.

[0044] Next, a description is given to a blending amount of these function-exhibiting substances, that is, the odor-reducing substance (m), the antiviral substance (n), and the anti-allergen substance (o), when they are used in combination.

[0045] When the odor-reducing substance (m) and the antiviral substance (n) are combined, a blending ratio by mass of the odor-reducing substance (m) to the antiviral substance (n) is preferably 1:0.5 to 2.50, and more preferably 1:0.60 to 2.0. When the blending ratio is less than the lower limit and exceeds the upper limit, the melamine decorative laminate is slightly less balanced as a product having both the odor reduction performance and the antiviral performance.

[0046] Furthermore, a total blending amount of the odor-reducing substance (m) and the antiviral substance (n) in the composition is preferably 60 to 150 parts by mass, and more preferably 75 to 115 parts by mass with respect to 100 parts by mass in solid content of the composition. When the total blending amount falls within this range, the decorative laminate is excellent particularly in appearance, the odor reduction performance, and the antiviral performance. That is, when the total blending amount is less than the lower limit, the odor reduction performance and the antiviral performance are slightly worsened. When the total blending amount exceeds the upper limit, minor unevenness due to blushing is prone to occur in the appearance.

[0047] When the odor-reducing substance (m) and the anti-allergen substance (o) are combined, a blending ratio by mass of the odor-reducing substance (m) to the anti-allergen substance (o) is preferably 1:0.03 to 2.0, and more preferably 1:0.08 to 1.8. When the blending ratio is less than the lower limit and exceeds the upper limit, the melamine decorative laminate is slightly less balanced as the

product having both the odor reduction performance and the anti-allergen performance.

[0048] Furthermore, a total blending amount of the odor-reducing substance (m) and the anti-allergen substance (o) in the composition is preferably 30 to 16 parts by mass, and more preferably 35 to 110 parts by mass with respect to 100 parts by mass in solid content of the composition. When the total blending amount falls within this range, the decorative laminate is excellent particularly in the appearance, the odor reduction performance, and the anti-allergen performance. That is, when the total blending amount is less than the lower limit, the odor reduction performance and the anti-allergen performance are slightly worsened. When the total blending amount exceeds the upper limit, minor unevenness due to blushing is prone to occur in the appearance.

[0049] When the antiviral substance (n) and the anti-allergen substance (o) are combined, a blending ratio by mass of the antiviral substance (n) to the anti-allergen substance (o) is preferably 1:0.01 to 2.0, and more preferably 1:0.06 to 1.50. When the blending ratio is less than the lower limit and exceeds the upper limit, the melamine decorative laminate is slightly less balanced as the product having both the antiviral performance and the anti-allergen performance.

[0050] Furthermore, a total blending amount of the antiviral substance (n) and the anti-allergen substance (o) in the composition is preferably 15 to 200 parts by mass, and more preferably 35 to 125 parts by mass with respect to 100 parts by mass in solid content of the composition. When the total blending amount falls within this range, the decorative laminate is excellent particularly in the appearance, the antiviral performance, and the anti-allergen performance. That is, when the total blending amount is less than the lower limit, the antiviral performance and the anti-allergen performance are slightly worsened. When the total blending amount exceeds the upper limit, the unevenness due to blushing is prone to occur in the appearance.

[0051] When the odor-reducing substance (m), the antiviral substance (n), and the anti-allergen substance (o) are combined, a blending ratio by mass of the odor-

reducing substance (m) to the antiviral substance (n) to the anti-allergen substance (o) is preferably 1:0.20 to 7.0:0.05 to 5.5, and more preferably 1:0.6 to 4.5:0.15 to 3.0. Furthermore, a total blending amount of the odor-reducing substance (m), the antiviral substance (n), and the anti-allergen substance (o) in the composition is preferably 30 to 170 parts by mass, and more preferably 50 to 120 parts by mass with respect to 100 parts by mass in solid content of the composition. When the blending ratio and the total blending amount fall within these ranges, the decorative laminate is well-balanced in the appearance, the odor reduction performance, the antiviral performance, and the anti-allergen performance. Furthermore, a synergistic effect makes the decorative laminate exhibit an effect equal to or greater than effects exerted individually by the above function-exhibiting substances even when an amount of coating is small. Needless to say, in order to emphasize each function, it is possible to properly adjust the blending amount of the odor-reducing substance (m), the antiviral substance (n), and the anti-allergen substance (o) in a desired range.

[0052] A decorative layer includes a cured product made of melamine resin. The decorative layer includes a melamine resin-impregnated patterned paper that is produced by impregnating a decorative paper having a basis weight of approximately 80 to 140 g/m² with a resin liquid composed mainly of melamine resin (hereinafter, referred to as “melamine resin liquid”), and drying the same. Over the melamine resin-impregnated patterned paper, a melamine resin-impregnated overlay paper may be placed to protect a pattern of the decorative paper, to thereby provide an overlay layer. The melamine resin-impregnated overlay paper is produced by impregnating an overlay paper having a basis weight of approximately 16 to 60 g/m² with the melamine resin liquid, and drying the same. The overlay layer also includes a cured product made of melamine resin. On a surface of the decorative layer or a surface of the overlay layer, a cured layer is formed as a front surface layer, and the cured layer is made of the above-described composition or a composition (hereinafter, referred to as “functional composition”) containing the function-exhibiting substance in

addition to the above-described composition. Example ways to be employed to form the cured layer include a coating method and a transfer method. The coating method includes, in impregnating the decorative paper or the overlay paper with the melamine resin liquid, applying the surface with a coating liquid that contains the composition and the functional composition after impregnation with the melamine resin liquid. The transfer method includes using a transfer sheet that is produced by coating a sheet-like base material with the functional composition. In the transfer method, for example, a stacked product is formed under heat and pressure so as to have: the transfer sheet including the cured layer that is made of the functional composition on one surface of the sheet-like base material, the melamine resin-impregnated patterned paper, and a core material in this order. Alternatively, when the melamine resin-impregnated overlay paper is used, the melamine resin-impregnated overlay paper is additionally placed over the melamine resin-impregnated patterned paper, and is then formed under heat and pressure. In the stacked product, a side of the transfer sheet provided with the cured layer faces the melamine resin-impregnated patterned paper or the melamine resin-impregnated overlay paper. Subsequently, the sheet-like base material is removed.

[0053] An impregnation rate of the melamine resin liquid defined by Formula 1 is preferably in a range of 70 to 160%.

<Formula 1>

[0054] [Formula 1]

$$\text{Impregnation rate} = \frac{\text{Weight after impregnation} - \text{Weight before impregnation}}{\text{Weight before impregnation}} \times 100$$

(%)

Examples of the sheet-like base material to be used in the transfer method include a plastic film and a metal foil. Examples of the plastic film include a polyester film, a polyethylene film, a polypropylene film, cellophane, a diacetyl

cellulose film, a triacetyl cellulose film, a acetyl cellulose butyrate film, a polyvinyl chloride film, a polyvinylidene chloride film, a polyvinyl alcohol film, an ethylene vinyl alcohol film, a polystyrene film, a polycarbonate film, a polymethylpentene film, a polysulfone film, a polyetherketone film, a polyethersulfone film, a polyetherimide film, a polyimide film, a fluoroplastic film, a nylon film, and an acrylic film.

[0055] Examples of the metal foil include a gold foil, a silver foil, a copper foil, a zinc foil, an indium foil, an aluminum foil, a tin foil, an iron foil (including stainless steel (SUS) foil), and a titanium foil.

[0056] When the sheet-like base material is coated with the coating liquid containing the functional composition according to the transfer method, a known method can be used, for example, spray coating method, gravure coating method, bar coating method, knife coating method, roll coating method, blade coating method, die coating method, curtain coating method, reverse coating method, or comma coating method can be used. The transfer sheet obtained by the method described above is stacked on a melamine resin-impregnated paper such that the melamine resin-impregnated paper to be a top most layer abuts a coating surface of the transfer sheet, that is, the surface of the transfer sheet provided with the cured layer made of the functional composition, and then the transfer sheet stacked is formed under heat and pressure together with the core material forming a core layer.

[0057] A description is provided in details to an application thickness of the coating liquid containing the functional composition. When the odor-reducing substance (m) is contained in the functional composition (hereinafter, referred to as “odor-reducing function exhibiting composition”), the application thickness of the coating liquid containing the odor-reducing function exhibiting composition is preferably 2.0 to 6.5 μm in a dried state in both the coating method and the transfer method. When this application thickness is equal to or greater than the lower limit, the odor reduction performance is further exhibited. When the application thickness exceeds the upper limit, the unevenness due to

blushing is prone to occur in the appearance. When the antiviral substance (n) is contained in the functional composition (hereinafter, referred to as “antiviral function exhibiting composition”), the application thickness of the coating liquid containing the antiviral function exhibiting composition is preferably 1.5 to 3.5 μm in a dried state in both the coating method and the transfer method. When this application thickness is less than the lower limit, the antiviral performance is not easily exhibited. When the application thickness exceeds the upper limit, the unevenness due to blushing is prone to occur in the appearance. When the above-described anti-allergen substance (o) is contained in the functional composition (hereinafter, referred to as “anti-allergen function exhibiting composition”), the application thickness of the coating liquid containing the anti-allergen function exhibiting composition is preferably 2.0 to 8.0 μm in a dried state in both the coating method and the transfer method. When this application thickness is less than the lower limit, the anti-allergen performance is not easily exhibited. When the application thickness exceeds the upper limit, the unevenness due to blushing is prone to occur in the appearance.

[0058] Furthermore, it is preferred that a pH of the coating liquid containing the functional composition is 3 or higher in both the coating method and the transfer method. When the pH is less than 3, a lattice structure of the components (A) is destroyed, and as a result, the unevenness due to blushing is prone to occur in the surface of the decorative laminate. The pH of the coating liquid means a pH measured in a coating liquid that is prepared so as to have a concentration of 20% by mass in solid content (a concentration of the above-described solid content contained in the functional composition in the coating liquid). Still further, a pH value conforms to Japanese Industrial Standards (JIS) Z8802:2011 “pH measuring method” and is obtained based on an operation of glass electrode method.

[0059] When the coating liquid contains a composition that does not contain the function-exhibiting substance, the application thickness of the coating liquid is preferably 2.0 to 8.0 μm in a dried state in both the application method and the

transfer method. When this application thickness is less than the lower limit, fingerprint adhesion is easily noticeable. When the application thickness exceeds the upper limit, the unevenness due to blushing is prone to occur in the appearance. Furthermore, the pH of this coating liquid is preferably 3 or higher as in the case where the function-exhibiting substance is contained. A pH measuring method is the same as in the case where the function-exhibiting substance is contained.

[0060] As the core material, a thermosetting resin-impregnated core paper can be used. The thermosetting resin-impregnated core paper can be obtained by impregnating an organic fibrous base material, such as a kraft paper and a bleached kraft paper, with a resin liquid composed mainly of resin as a binder, for example, thermosetting resin such as phenol-formaldehyde resin and melamine-formaldehyde resin, and drying the organic fibrous base material impregnated with the resin liquid.

[0061] Furthermore, a prepreg may be used other than the thermosetting resin-impregnated core paper described above for the reason that non-combustibility can be provided. The prepreg is obtained by impregnating, with a slurry containing an inorganic filler and a binder component, a base material such as a non-woven fabric or a woven fabric made from inorganic fiber, such as glass fiber, rock wool, carbon fiber, and ceramic fiber, and drying the base material impregnated with the slurry. Particularly, a preferable base material is a glass fiber non-woven fabric that is excellent in heat and flame resistance, and impregnation properties of the slurry.

[0062] Examples of the inorganic filler include endothermic metal hydroxide, such as aluminum hydroxide and magnesium hydroxide, and an inorganic substance other than the endothermic metal hydroxide, such as calcium carbonates, talc, and fly ash; and one or more of these examples can be used. For the endothermic metal hydroxide, it is preferable to use aluminum hydroxide or magnesium hydroxide as they contain water of crystallization, and decompose at a high temperature and absorb heat to release the water of crystallization and

are therefore advantageous in non-combustibility.

[0063] When the endothermic metal hydroxide and the inorganic substance other than the endothermic metal hydroxide are used together, it is preferred that a blending amount of the endothermic metal hydroxide is 2 to 15 parts by mass with respect to 1 part by mass of the inorganic substance other than the endothermic metal hydroxide. This is because a smooth and good surface appearance can be obtained. Furthermore, when the blending amount of the endothermic metal hydroxide is 2 parts by mass or more with respect to 1 part by mass of the inorganic substance other than the endothermic metal hydroxide, the decorative laminate is excellent in non-combustibility. Still further, when the blending amount of the endothermic metal hydroxide is 15 parts by mass or less with respect to 1 part by mass of the inorganic substance other than the endothermic metal hydroxide, sedimentation of metal hydroxide in the slurry does not easily occur, thus facilitating control of the amount of impregnation of the slurry. Still further, due to the blending amount of the endothermic metal hydroxide being equal to or less than 15 parts by mass with respect to 1 part by mass of the inorganic substance other than the endothermic metal hydroxide, wear of a cutter to be used for cutting the decorative laminate can be reduced.

[0064] Examples of the binder include the thermosetting resin, such as an amino-formaldehyde resin, a phenol-formaldehyde resin, or a mixture resin thereof. A blending mass ratio in solid content of the binder component to the inorganic filler is desirably 5 to 20:95 to 80. When the amount of the binder component is too large, non-combustibility is prone to decrease, whereas when the amount of the binder component is too small, adhesion between prepregs is prone to be degraded.

[0065] An impregnation rate (%) of the slurry into the inorganic fibrous base material is preferably in a range of 500 to 3000% in accordance with a calculation method shown in Formula 1 discussed above. The impregnation rate exceeding the upper limit often causes fall-off of the solid content of the slurry from the prepreg and thus makes the prepreg difficult to handle.

Furthermore, the impregnation rate less than the lower limit easily causes separation between layers.

[0066] For other core materials, calcium silicate, a plywood, a medium density fiberboard, a particle board, and the like can be used. There is no particular limitation to the core material.

[0067] A backer material is disposed to be stacked on a back surface of the core material and formed under heat and pressure in a case of suppressing curling of the melamine decorative laminate due to contraction of the melamine decorative laminate. Examples of the backer material include a melamine-impregnated paper and a phenol-impregnated paper in which a fibrous base material is used for a base material. For the fibrous base material, an α - cellulose paper, a titanium paper, a kraft paper, or a bleached kraft paper can be used.

[Examples]

[0068] The present disclosure will be described below with reference to examples, experiment examples, and comparative examples. However, the present disclosure is not limited by these examples shown below.

[0069] [Example 1]

1. Production of the composition including the components (A), (B), and (C)

A composition including the following (A), (B), and (C) was obtained: (A) 100 parts by mass (in terms of solid content) of a tetraethyl orthosilicate (ethyl silicate) hydrolysis solution (trade name: "HAS-1" manufactured by Colcoat Co., Ltd.) as the hydrolytic condensate of silicon alkoxide; (B) 600 parts by mass (in terms of solid content) of "NPC-ST-30" (trade name, manufactured by Nissan Chemical Corporation, average particle diameter: 10 to 15 nm, ethylene glycol mono-n-propyl ether-dispersed silica sol, SiO₂: 30% by mass) as the organo silica sol dispersed in the hydrophilic solvent; and (C) 13.2 parts by mass (in terms of solid content) of "DISPERBYK-2009" (acrylic copolymer solution, acrylic copolymer: 44% by mass, 1-methoxy-2-propyl acetate, ethylene glycol monobutyl ether) (trade name, manufactured by BYK-Chemie Japan K. K.) as

the acrylic polymer having a hydrophilic group and a hydrophobic group.

[0070] 2. Production of Odor-reducing Function Exhibiting Composition

An odor-reducing function exhibiting composition (M) was obtained by blending and stirring, using the homogenizer at 8100 rpm for 10 minutes, 40 parts by mass of the odor-reducing substance (m) containing 74% by mass of zinc oxide and 26% by mass of amino modified silica and having an average particle diameter of 350 nm with respect to 100 parts by mass in solid content of the composition including the components (A), (B), and (C) produced in the section 1 above.

[0071] 3. Production of Transfer Sheet

A transfer sheet (M) was obtained by coating a plastic film with a coating liquid containing the odor-reducing function exhibiting composition (M) such that a coating thickness after drying is 4.5 μm . The coating liquid was prepared so as to have a concentration of the solid content, that is, a concentration of the above-described solid content contained in the functional composition in the coating liquid is 20% by mass. Furthermore, the coating liquid has a pH of 5.8. The pH of the coating liquid was measured with a glass electrode pH meter (trade name: LAQUA; model number: F-71; manufactured by HORIBA LTD.). Hereinafter, the same applies to other examples, comparative examples, and experimental examples.

[0072] 4. Production of Melamine Resin-impregnated Patterned Paper (M)

A melamine resin-impregnated patterned paper (M) was obtained by impregnating a resin liquid (AA) composed mainly of melamine-formaldehyde resin into a decorative paper for a decorative laminate having a brown color and a basis weight of 100 g/m^2 . The impregnation rate of the melamine resin-impregnated patterned paper (M) defined by Formula 1 was 140%. The surface of the decorative paper was printed with a wood grain pattern having wood conduit pattern part.

[0073] 5. Production of Prepreg

The prepreg was obtained by impregnating a glass fiber base material of

50 g/m² with a slurry such that the impregnation rate based on Formula 1 is 1200% and drying the glass fiber base material impregnated with the slurry. The slurry contained melamine-formaldehyde resin and phenol-formaldehyde resin as the binder component, and an inorganic filler such as aluminum hydroxide and calcium carbonates as the inorganic filler. In the slurry, a mass ratio of the binder component to the inorganic filler in solid content was 8:92.

[0074] 6. Production of Backer

A backer was obtained by impregnating a decorative paper of 80 g/m² for a decorative laminate with a resin liquid composed mainly of melamine-formaldehyde resin such that the impregnation rate defined by Formula 1 is 150% and drying the decorative paper impregnated with the resin liquid.

[0075] 7. Production of Decorative Laminate

The melamine decorative laminate was obtained by: stacking one sheet of the backer, five sheets of the prepreg, one sheet of the melamine resin-impregnated patterned paper (M), and one sheet of the transfer sheet (M) in this order from the bottom; forming the stacked product under heat and pressure with a flat-finish plate under the conditions of: 140°C, 100 kg/cm², and 90 minutes; and removing the plastic film.

[0076] [Example 2]

A melamine decorative laminate was produced in the same manner as in Example 1, except that 60 parts by mass of the odor-reducing substance (m) was blended.

[0077] [Example 3]

A melamine decorative laminate was produced in the same manner as in Example 1, except that 30 parts by mass of the odor-reducing substance (m) was blended.

[0078] [Example 4]

A melamine decorative laminate was produced in the same manner as in Example 1, except that 9.3 parts by mass of "DISPERBYK-2009" of the component (C) was blended.

[0079] [Example 5]

A melamine decorative laminate was produced in the same manner as in Example 1, except that 16.8 parts by mass of “DISPERBYK-2009” of the component (C) was blended.

[0080] [Example 6]

A melamine decorative laminate was produced in the same manner as in Example 1, except that 400 parts by mass of “NPC-ST-30” of the component (B) was blended.

[0081] [Example 7]

A melamine decorative laminate was produced in the same manner as in Example 1, except that 900 parts by mass of “NPC-ST-30” of the component (B) was blended.

[0082] [Example 8]

A melamine decorative laminate was produced in the same manner as in Example 1, except that the average particle diameter of the odor-reducing substance (m) was 200 nm.

[0083] [Example 9]

A melamine decorative laminate was produced in the same manner as in Example 1, except that the average particle diameter of the odor-reducing substance (m) was 1000 nm.

[0084] [Example 10]

A melamine decorative laminate was produced in the same manner as in Example 1, except that the coating liquid containing the odor-reducing function exhibiting composition (M) was applied such that the coating thickness thereof after drying is 2.0 μm .

[0085] [Example 11]

A melamine decorative laminate was produced in the same manner as in Example 1, except that the coating liquid containing the odor-reducing function exhibiting composition (M) was applied such that the coating thickness thereof after drying is 6.5 μm .

[0086] [Example 12]

A melamine decorative laminate was produced in the same manner as in Example 1, except that the odor-reducing substance (m) containing 45% of zinc oxide and 55% of amino modified silica was used.

[0087] [Example 13]

A melamine decorative laminate was produced in the same manner as in Example 1, except that the odor-reducing substance (m) containing 85% of zinc oxide and 15% of amino modified silica was used.

[0088] [Example 14]

1. Production of Antiviral Function Exhibiting Composition

An antiviral function exhibiting composition (N) was obtained by: blending 50 parts by mass of the antiviral substance (n), which is a triazine-imidazole-thiazole-based organic synthetic antiviral substance with an average particle diameter of 1000 nm, with respect to 100 parts by mass in solid content of the composition including the components (A), (B), and (C) according to Example 1; and stirring the antiviral substance (n) blended using the homogenizer at 8100 rpm for 10 minutes.

[0089] 2. Production of Transfer Sheet

A transfer sheet (N) was obtained by applying a plastic film with a coating liquid containing the antiviral function exhibiting composition (N) such that a coating thickness after drying is 2.2 μm . The coating liquid had a pH of 8.3.

[0090] 3. Production of Decorative Laminate

A melamine decorative laminate was produced in the same manner as in Example 1, except that the above-described transfer sheet (N) was used in place of the transfer sheet (M).

[0091] [Example 15]

A melamine decorative laminate was produced in the same manner as in Example 14, except that 26.4 parts by mass of "DISPERBYK-2009" of the component (C), and 35 parts by mass of the antiviral substance (n) were blended.

[0092] [Example 16]

A melamine decorative laminate was produced in the same manner as in Example 14, except that 26.4 parts by mass of “DISPERBYK-2009” of the component (C) and 75 parts by mass of the antiviral substance (n) were blended.

[0093] [Example 17]

A melamine decorative laminate was produced in the same manner as in Example 14, except that 9.3 parts by mass of “DISPERBYK-2009” of the component (C) was blended.

[0094] [Example 18]

A melamine decorative laminate was produced in the same manner as in Example 14, except that 16.8 parts by mass of “DISPERBYK-2009” of the component (C) was blended.

[0095] [Example 19]

A melamine decorative laminate was produced in the same manner as in Example 14, except that 26.4 parts by mass of “DISPERBYK-2009” of the component (C) was blended, and the coating liquid containing the antiviral function exhibiting composition was applied such that the coating thickness after drying is 3.5 μm .

[0096] [Example 20]

A melamine decorative laminate was produced in the same manner as in Example 19, except that the coating liquid containing the antiviral function exhibiting composition was applied such that the coating thickness after drying is 1.5 μm .

[0097] [Example 21]

A melamine decorative laminate was produced in the same manner as in Example 19, except that the average particle diameter of the antiviral substance (n) was 3000 nm, and the coating liquid containing the antiviral function exhibiting composition was applied such that the coating thickness after drying is 2.2 μm .

[0098] [Example 22]

A melamine decorative laminate was produced in the same manner as in

Example 21, except that the average particle diameter of the antiviral substance (n) was 500 nm.

[0099] [Example 23]

1. Production of Anti-allergen Function Exhibiting Composition

An anti-allergen function exhibiting composition (O) was obtained by: blending, as an anti-allergen substance (o), 10 parts by mass of an organic synthetic anti-allergen substance ("Allerbuster BV" manufactured by Sekisui Material Solutions Co., Ltd.), which has an average particle diameter of 2000 nm and is a composite of sodium salt of acidic anion-modified linear alkane and styrene particles, with respect to 100 parts by mass in solid content of the composition including the components (A), (B), and (C) according to Example 1; and stirring the organic synthetic anti-allergen substance blended using the homogenizer at 8100 rpm for 10 minutes.

[0100] 2. Production of Transfer Sheet

A transfer sheet (O) was obtained by applying a plastic film with a coating liquid containing the anti-allergen function exhibiting composition (O) such that a coating thickness after drying is 4.0 μm . The coating liquid had a pH of 6.8.

[0101] 3. Production of Decorative Laminate

A melamine decorative laminate was produced in the same manner as in Example 1, except that the above-described transfer sheet (O) was used in place of the transfer sheet (M).

[0102] [Example 24]

A melamine decorative laminate was produced in the same manner as in Example 23, except that 3 parts by mass of the anti-allergen substance (o) was blended.

[0103] [Example 25]

A melamine decorative laminate was produced in the same manner as in Example 23, except that 50 parts by mass of the anti-allergen substance (o) was blended.

[0104] [Example 26]

A melamine decorative laminate was produced in the same manner as in Example 23, except that a substance used as the anti-allergen substance (o) was the organic synthetic anti-allergen substance (“Allerbuster BV” manufactured by Sekisui Material Solutions Co., Ltd.) having an average particle diameter of 5000 nm, which is a composite of sodium salt of acidic anionic-modified linear alkane and styrene particles.

[0105] [Example 27]

A melamine decorative laminate was produced in the same manner as in Example 23, except that a substance used as the anti-allergen substance (o) was the organic synthetic anti-allergen substance (“Allerbuster BV” manufactured by Sekisui Material Solutions Co., Ltd.) having an average particle diameter of 1000 nm, which is a composite of sodium salt of acidic anion-modified linear alkane and styrene particles.

[0106] [Example 28]

A melamine decorative laminate was produced in the same manner as in Example 23, except that a coating liquid containing an anti-allergen composition was applied such that a coating thickness after drying is 2.0 μm .

[0107] [Example 29]

A melamine decorative laminate was produced in the same manner as in Example 23, except that a coating liquid containing an anti-allergen composition was applied such that the coating thickness after drying is 8.0 μm .

[0108] [Example 30]

A melamine decorative laminate was produced in the same manner as in Example 23, except that 900 parts by mass of “NPC-ST-30” of the component (B) was blended.

[0109] [Example 31]

A melamine decorative laminate was produced in the same manner as in Example 23, except that 300 parts by mass of “NPC-ST-30” of the component (B) was blended.

[0110] [Example 32]

1. Production of Thermosetting Resin-impregnated Core Paper

A phenol resin-impregnated core paper was obtained as the thermosetting resin-impregnated core paper by: impregnating a kraft paper having a basis weight of 200 g/m² with a resin liquid composed mainly of a phenol-formaldehyde resin such that the impregnation rate defined by Formula 1 is 50%; and drying the kraft paper impregnated with the resin liquid.

[0111] 2. Production of Decorative Laminate

A melamine decorative laminate was obtained by: stacking five sheets of the phenol resin-impregnated core paper, one sheet of the same melamine resin-impregnated patterned paper (M) as in Example 1, and one sheet of the transfer sheet (M) in this order from the bottom; forming the stacked product under heat and pressure with a flat finish plate under the conditions of: 140°C, 100 kg/cm², and 90 minutes; and removing the plastic film.

[0112] [Example 33]

A melamine decorative laminate was produced in the same manner as in Example 2, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0113] [Example 34]

A melamine decorative laminate was produced in the same manner as in Example 3, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0114] [Example 35]

A melamine decorative laminate was produced in the same manner as in Example 32, except that the average particle diameter of the odor-reducing substance (m) was 200 nm.

[0115] [Example 36]

A melamine decorative laminate was produced in the same manner as in Example 32, except that the average particle diameter of the odor-reducing substance (m) was 1000 nm.

[0116] [Example 37]

A melamine decorative laminate was produced in the same manner as in Example 32, except that the coating liquid containing the odor-reducing function exhibiting composition was applied such that the coating thickness after drying is 2.5 μm .

[0117] [Example 38]

A melamine decorative laminate was produced in the same manner as in Example 32, except that the coating liquid containing the odor-reducing function exhibiting composition was applied such that the coating thickness after drying is 6.5 μm .

[0118] [Example 39]

A melamine decorative laminate was produced in the same manner as in Example 14, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0119] [Example 40]

A melamine decorative laminate was produced in the same manner as in Example 15, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0120] [Example 41]

A melamine decorative laminate was produced in the same manner as in Example 16, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0121] [Example 42]

A melamine decorative laminate was produced in the same manner as in Example 19, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0122] [Example 43]

A melamine decorative laminate was produced in the same manner as in Example 20, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0123] [Example 44]

A melamine decorative laminate was produced in the same manner as in Example 39, except that the average particle diameter of the antiviral substance (n) was 3000 nm.

[0124] [Example 45]

A melamine decorative laminate was produced in the same manner as in Example 39, except that the average particle diameter of the antiviral substance (n) was 500 nm.

[0125] [Example 46]

A melamine decorative laminate was produced in the same manner as in Example 23, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0126] [Example 47]

A melamine decorative laminate was produced in the same manner as in Example 24, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0127] [Example 48]

A melamine decorative laminate was produced in the same manner as in Example 25, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0128] [Example 49]

A melamine decorative laminate was produced in the same manner as in Example 26, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0129] [Example 50]

A melamine decorative laminate was produced in the same manner as in Example 27, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0130] [Example 51]

A melamine decorative laminate was produced in the same manner as in Example 28, except that the phenol resin-impregnated core paper was used in

place of the prepreg, and the backer was not used.

[0131] [Example 52]

A melamine decorative laminate was produced in the same manner as in Example 29, except that the phenol resin-impregnated core paper was used in place of the prepreg, and the backer was not used.

[0132] [Example 53]

A melamine decorative laminate was produced in the same manner as in Example 1, except that zeolite was used as the odor-reducing substance (m).

[0133] [Example 54]

A melamine decorative laminate was produced in the same manner as in Example 1, except that copper oxide was used as the odor-reducing substance (m).

[0134] [Example 55]

A melamine decorative laminate was produced in the same manner as in Example 1, except that zirconium oxide was used as the odor-reducing substance (m).

[0135] [Example 56]

A melamine decorative laminate was produced in the same manner as in Example 14, except that amino-modified polyvinyl alcohol particles were used as the antiviral substance (n).

[0136] [Example 57]

A melamine decorative laminate was produced in the same manner as in Example 14, except that amino-modified acrylic particles were used as the antiviral substance (n).

[0137] [Example 58]

A melamine decorative laminate was produced in the same manner as in Example 23, except that acidic anion-modified polyvinyl alcohol was used, as the anion-modified organic compound in the anti-allergen substance (n), in place of sodium salt of acidic anion-modified linear alkane.

[0138] [Example 59]

A melamine decorative laminate was produced in the same manner as in Example 23, except that silver oxide particles were used, as the carrier in the anti-allergen substance (n), in place of styrene particles.

[0139] [Example 60]

A melamine decorative laminate was produced in the same manner as in Example 1, except that the composition including the components (A), (B), and (C) obtained in Example 1 was used in place of the odor-reducing function exhibiting composition (M).

[0140] [Example 61]

A melamine decorative laminate was produced in the same manner as in Example 1, except that a melamine resin-impregnated patterned paper (Mt) and production methods to be described below were used.

[0141] <Production of Melamine Resin-impregnated Patterned Paper (Mt)>

A decorative paper for a decorative laminate having a basis weight of 100 g/m² and brown color was impregnated with a resin liquid (AA) composed mainly of a melamine-formaldehyde resin such that the impregnation rate defined by Formula 1 is 140%. Then, the decorative paper was coated with the coating liquid containing the odor-reducing function exhibiting composition (M) according to Example 1 such that the coating thickness after drying is 4.5 μm. Accordingly, a melamine resin-impregnated patterned paper (Mt) was obtained. The surface of the decorative paper was printed with a wood grain pattern having wood conduit pattern part.

[0142] <Production of Decorative Laminate>

A melamine decorative laminate was obtained by: stacking one sheet of the backer, five sheets of the prepreg, and one sheet of the melamine resin-impregnated patterned paper (Mt) in this order from the bottom; and forming the stacked product under heat and pressure with a flat finish plate under the conditions of: 140°C, 100 kg/cm², and 90 minutes.

[0143] [Example 62]

A decorative laminate was produced in the same manner as in Example 14,

except that a melamine resin-impregnated patterned paper (Nt) and production methods to be described below were used.

[0144] <Production of Melamine Resin-impregnated Patterned Paper (Nt)>

An impregnated paper was obtained by impregnating a decorative paper for a decorative laminate having a basis weight of 100 g/m² and a brown color with the resin liquid (AA) composed mainly of the melamine-formaldehyde resin such that the impregnation rate defined by Formula 1 is 140%. Then, the melamine resin-impregnated patterned paper (Nt) was obtained by applying a surface of the impregnated paper with the coating liquid containing the antiviral function exhibiting composition (N) according to Example 14 such that the coating thickness after drying is 2.2 μm. The surface of the decorative paper was printed with a wood grain pattern having wood conduit pattern part.

[0145] <Production of Decorative Laminate>

A melamine decorative laminate was obtained by: stacking one sheet of the backer, five sheets of the prepreg, and one sheet of the melamine resin-impregnated patterned paper (Nt) in this order from the bottom; and forming the stacked product under heat and pressure with a flat finish plate under the conditions of: 140°C, 100 kg/cm², and 90 minutes.

[0146] [Example 63]

A melamine decorative laminate was produced in the same manner as in Example 23, except that a melamine resin-impregnated patterned paper (Ot) and production methods to be described below were used.

[0147] <Production of Melamine Resin-impregnated Patterned Paper (Ot)>

An impregnated paper was obtained by impregnating a decorative paper for a decorative laminate having a basis weight of 100 g/m² and brown color with the resin liquid (AA) composed mainly of the melamine-formaldehyde resin such that the impregnation rate defined by Formula 1 is 140%. Then, the melamine resin-impregnated patterned paper (Ot) was obtained by applying a surface of the impregnated paper with the coating liquid containing the anti-allergen function exhibiting composition (O) according to Example 23 such that

the coating thickness after drying is 4.0 μm . The surface of the decorative paper was printed with a wood grain pattern having wood conduit pattern part.

[0148] <Production of Decorative Laminate>

A melamine decorative laminate was obtained by: stacking one sheet of the backer, five sheets of the prepreg, and one sheet of the melamine resin-impregnated patterned paper (Ot) in this order from the bottom; and forming the stacked product under heat and pressure with a flat finish plate under the conditions of: 140°C, 100 kg/cm², and 90 minutes.

[0149] [Comparative Example 1]

A melamine decorative laminate was produced in the same manner as in Example 1, except that, in place of the hydrolytic condensate of silicon alkoxide (A), siloxane-grafted polymer (trade name: "ZX-036", hydroxyl value: 119, kinds of solvent: butyl acetate/2-propanol, manufactured by Fuji Kasei Kogyo Co., Ltd.) in which acrylic resin and siloxane are combined was used.

[0150] [Comparative Example 2]

A melamine decorative laminate was produced in the same manner as in Example 1, except that, in place of the organo silica sol dispersed in the hydrophilic solvent (B), hydrophobic silica sol (trade name "SYLOPHOBIC" manufactured by Fuji Silysia Chemical Ltd.) was used.

[0151] [Comparative Example 3]

A melamine decorative laminate was produced in the same manner as in Example 1, except that, in place of the acrylic polymer having a hydrophilic group and a hydrophobic group (C), 100 parts by mass of a methacryloyl functional group-containing acrylic polymer (trade name "RA-3705MB" manufactured by Negami Chemical Industrial Co., Ltd.) was used as a reactive (meth) acrylic polymer (x), and 0.4 parts by mass of 1,6-Bis (*t*-butylperoxycarbonyloxy) hexane (trade name "KAYALANE 6-70" manufactured by Kayaku Akzo Co., Ltd.) was blended as a thermal polymerization initiator.

[0152] [Comparative Example 4]

A melamine decorative laminate was produced in the same manner as in Comparative Example 3, except that the function-exhibiting substance was not contained.

[0153] [Comparative Examples 5 through 9]

Melamine decorative laminates were produced in the same manner as in Comparative Example 3, except that conditions were changed as indicated in Tables 4-1 and 4-2.

[0154] [Examples 64 through 78]

Melamine decorative laminates were produced in the same manner as in Example 1, except that conditions were changed as indicated in Tables 5-1 and 5-2. In Examples 64 through 78, the same odor-reducing substance as in Example 1 was used as the odor-reducing substance (m), the same antiviral substance as in Example 14 was used as the antiviral substance (n), and the same anti-allergen substance as in Example 23 was used as the anti-allergen substance (o).

[0155] [Examples 79 through 93]

Decorative laminates were produced in the same manner as in Example 1, except that conditions were changed as indicated in Tables 6-1 and 6-2. In Examples 79 through 93, the same odor-reducing substance as in Example 1 was used as the odor-reducing substance (m), the same antiviral substance as in Example 14 was used as the antiviral substance (n), and the same anti-allergen substance as in Example 23 was used as the anti-allergen substance (o).

[0156] In Example 88, however, in place of "HAS-1", "HAS-6", which is a hydrolytic condensate of tetraethyl orthosilicate (ethyl silicate), was used as the component (A). In Example 89, in place of "HAS-1", "HAS-10", which is a hydrolytic condensate of tetraethyl orthosilicate (ethyl silicate) was used as the component (A). In Example 90, in place of "NPC-ST-30", "IPA-ST" (trade name, manufactured by Nissan Chemical Corporation, average particle diameter: 10 to 15 nm, isopropyl alcohol-dispersed silica sol, SiO₂: 30% by mass) was used as the component (B). In Example 91, in place of "NPC-ST-30", "MEK-AC-

2140Z” (trade name, manufactured by Nissan Chemical Corporation, average particle diameter: 10 to 15 nm, methyl ethyl ketone-dispersed silica sol, SiO₂: 40% by mass) was used as the component (B). In Example 92, in place of “DISPERBYK-2009”, “DISPERBYK-2000” (acrylic copolymer solution, acrylic copolymer: 40% by mass, 1-methoxy-2-propyl acetate, ethylene glycol monobutyl ether) (trade name, manufactured by BYK-Chemie Japan K.K) was used as the component (C). In Example 93, in place of “DISPERBYK-2009”, “DISPERBYK-2008” (acrylic copolymer solution, acrylic copolymer: 60% by mass, polypropylene glycol: 40%, trade name, manufactured by BYK Chemie Japan K.K) was used as the component (C).

[0157] [Example 94]

<Production of Melamine Resin-impregnated Overlay Paper>

A melamine resin-impregnated overlay paper was obtained by impregnating an overlay paper having a basis weight of 22 g/m² with the same resin liquid (AA) as in Example 1. The impregnation rate of the melamine resin-impregnated overlay defined by Formula 1 was 260%.

[0158] <Production of Decorative Laminate>

The same transfer sheet as in Example 79 was prepared.

[0159] Furthermore, a melamine resin-impregnated patterned paper was obtained in the same manner as in Example 1, except that the impregnation rate defined by Formula 1 was set to 100%.

[0160] Still further, the same phenol resin-impregnated core paper as in Example 32 was prepared.

[0161] A melamine decorative laminate was obtained by: stacking five sheets of the phenol resin-impregnated core paper, one sheet of the melamine resin-impregnated patterned paper, one sheet of the melamine resin-impregnated overlay paper, and one sheet of the transfer sheet in this order from the bottom; forming the stacked product under heat and pressure with a flat finish plate under the conditions of: 140°C, 100 kg/cm², and 90 minutes; and removing the plastic film.

[0162] [Example 95]

A melamine decorative laminate was produced in the same manner as in Example 94, except that the transfer sheet according to Example 80 was used.

[0163] [Example 96]

A melamine decorative laminate was produced in the same manner as in Example 94, except that the transfer sheet according to Example 81 was used.

[0164] [Experiment Examples 1 through 6]

Melamine decorative laminates were produced in the same manner as in Example 1, except that conditions were changed as indicated in Tables 7-1 and 7-2.

[0165] [Experiment Examples 7 through 10]

Melamine decorative laminates were produced in the same manner as in Example 1, except that conditions were changed as indicated in Tables 8-1 and 8-2.

[0166] [Experiment Examples 11 through 22]

Melamine decorative laminates were produced in the same manner as in Example 1, except that conditions were changed as indicated in Tables 9-1 and 9-2.

[0167] Regarding the above-described Examples, Experiment Examples, and Comparative Examples, Tables 1-1 through 9-2 show blending ratios of the composition including the components (A), (B), and (C) and the functional composition, particle diameters and pH of the function-exhibiting substance, coating amounts, and kinds of the core materials of the core layer.

[0168] The alphabets "A", "B", "C", "m", "n", and "o" in the tables indicate as follows.

[0169] A: the hydrolytic condensate of silicon alkoxide

B: the organo silica sol dispersed in the hydrophilic solvent

C: the acrylic polymer having a hydrophilic group and a hydrophobic group

m: the odor-reducing substance

n: the antiviral substance

o: the anti-allergen substance

The values of “A”, “B”, and “C” by parts by mass in the tables show values based on the solid content.

[0170] Furthermore, values of blending amounts of “m”, “n”, and “o” show blending ratios with respect to 100 parts by mass in solid content of the composition.

[0171] [Table 1-1]

	Composition					Function-exhibiting Substance		
	A	B	C			m	n	o
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition
Example 1	100	600	13.2	6	0.022	40	—	—
Example 2	100	600	13.2	6	0.022	60	—	—
Example 3	100	600	13.2	6	0.022	30	—	—
Example 4	100	600	9.3	6	0.016	40	—	—
Example 5	100	600	16.8	6	0.028	40	—	—
Example 6	100	400	13.2	4	0.033	40	—	—
Example 7	100	900	13.2	9	0.015	40	—	—
Example 8	100	600	13.2	6	0.022	40	—	—
Example 9	100	600	13.2	6	0.022	40	—	—
Example 10	100	600	13.2	6	0.022	40	—	—
Example 11	100	600	13.2	6	0.022	40	—	—
Example 12	100	600	13.2	6	0.022	40	—	—
Example 13	100	600	13.2	6	0.022	40	—	—
Example 14	100	600	13.2	6	0.022	—	50	—
Example 15	100	600	26.4	6	0.044	—	35	—
Example 16	100	600	26.4	6	0.044	—	75	—
Example 17	100	600	9.3	6	0.016	—	50	—
Example 18	100	600	16.8	6	0.028	—	50	—
Example 19	100	600	26.4	6	0.044	—	50	—
Example 20	100	600	26.4	6	0.044	—	50	—
Example 21	100	600	26.4	6	0.044	—	50	—
Example 22	100	600	26.4	6	0.044	—	50	—
Example 23	100	600	13.2	6	0.022	—	—	10
Example 24	100	600	13.2	6	0.022	—	—	3
Example 25	100	600	13.2	6	0.022	—	—	50
Example 26	100	600	13.2	6	0.022	—	—	10
Example 27	100	600	13.2	6	0.022	—	—	10
Example 28	100	600	13.2	6	0.022	—	—	10
Example 29	100	600	13.2	6	0.022	—	—	10
Example 30	100	900	13.2	9	0.015	—	—	10
Example 31	100	300	13.2	3	0.044	—	—	10

[0172]

[Table 1-2]

	Particle diameter of function-exhibiting substance /nm	pH of coating liquid	Coating amount (dry) / μm	Core material
Example 1	350	5.8	4.5	Prepreg
Example 2	350	5.7	4.5	Prepreg
Example 3	350	5.9	4.5	Prepreg
Example 4	350	5.8	4.5	Prepreg
Example 5	350	5.8	4.5	Prepreg
Example 6	350	5.6	4.5	Prepreg
Example 7	350	5.9	4.5	Prepreg
Example 8	200	5.8	4.5	Prepreg
Example 9	1000	5.8	4.5	Prepreg
Example 10	350	5.7	2.0	Prepreg
Example 11	350	5.8	6.5	Prepreg
Example 12	350	5.8	4.5	Prepreg
Example 13	350	5.8	4.5	Prepreg
Example 14	1000	8.3	2.2	Prepreg
Example 15	1000	8.1	2.2	Prepreg
Example 16	1000	8.5	2.2	Prepreg
Example 17	1000	8.3	2.2	Prepreg
Example 18	1000	8.4	2.2	Prepreg
Example 19	1000	8.5	3.5	Prepreg
Example 20	1000	8.6	1.5	Prepreg
Example 21	3000	8.3	2.2	Prepreg
Example 22	500	8.3	2.2	Prepreg
Example 23	2000	6.8	4.0	Prepreg
Example 24	2000	6.8	4.0	Prepreg
Example 25	2000	6.9	4.0	Prepreg
Example 26	5000	7.1	4.0	Prepreg
Example 27	1000	6.8	4.0	Prepreg
Example 28	2000	6.9	2.0	Prepreg
Example 29	2000	6.8	8.0	Prepreg
Example 30	2000	6.8	4.0	Prepreg
Example 31	2000	6.6	4.0	Prepreg

[0173] [Table 2-1]

	Composition					Function-exhibiting substance		
	A	B	C			m	n	o
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition
Example 32	100	600	13.2	6	0.022	40	—	—
Example 33	100	600	13.2	6	0.022	60	—	—
Example 34	100	600	13.2	6	0.022	30	—	—
Example 35	100	600	13.2	6	0.022	40	—	—
Example 36	100	600	13.2	6	0.022	40	—	—
Example 37	100	600	13.2	6	0.022	40	—	—
Example 38	100	600	13.2	6	0.022	40	—	—
Example 39	100	600	13.2	6	0.022	—	50	—
Example 40	100	600	26.4	6	0.044	—	35	—
Example 41	100	600	26.4	6	0.044	—	75	—
Example 42	100	600	26.4	6	0.044	—	50	—
Example 43	100	600	26.4	6	0.044	—	50	—
Example 44	100	600	26.4	6	0.044	—	50	—
Example 45	100	600	26.4	6	0.044	—	50	—
Example 46	100	600	13.2	6	0.022	—	—	10
Example 47	100	600	13.2	6	0.022	—	—	3
Example 48	100	600	13.2	6	0.022	—	—	50
Example 49	100	600	13.2	6	0.022	—	—	10
Example 50	100	600	13.2	6	0.022	—	—	10
Example 51	100	600	13.2	6	0.022	—	—	10
Example 52	100	600	13.2	6	0.022	—	—	10

[0174] [Table 2-2]

	Particle diameter of function- exhibiting substance /nm	pH of coating liquid	Coating amount (dry) /μm	Core material
Example 32	350	5.8	4.5	Impregnated core paper
Example 33	350	5.7	4.5	Impregnated core paper
Example 34	350	5.9	4.5	Impregnated core paper
Example 35	200	5.8	4.5	Impregnated core paper
Example 36	1000	5.8	4.5	Impregnated core paper
Example 37	350	5.8	2.5	Impregnated core paper
Example 38	350	5.8	6.5	Impregnated core paper
Example 39	1000	8.3	2.2	Impregnated core paper
Example 40	1000	8.1	2.2	Impregnated core paper
Example 41	1000	8.5	2.2	Impregnated core paper
Example 42	1000	8.5	3.5	Impregnated core paper
Example 43	1000	8.6	1.5	Impregnated core paper
Example 44	3000	8.3	2.2	Impregnated core paper
Example 45	500	8.3	2.2	Impregnated core paper
Example 46	2000	6.8	4.0	Impregnated core paper
Example 47	2000	6.8	4.0	Impregnated core paper
Example 48	2000	6.9	4.0	Impregnated core paper
Example 49	5000	6.9	4.0	Impregnated core paper
Example 50	1000	6.8	4.0	Impregnated core paper
Example 51	2000	6.8	2.0	Impregnated core paper
Example 52	2000	6.6	8.0	Impregnated core paper

[0175]

[Table 3-1]

	Composition					Function-exhibiting substance		
	A	B	C			m	n	o
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition
Example 53	100	600	13.2	6	0.022	40		
Example 54	100	600	13.2	6	0.022	40		
Example 55	100	600	13.2	6	0.022	40		
Example 56	100	600	13.2	6	0.022	—	50	
Example 57	100	600	13.2	6	0.022	—	50	
Example 58	100	600	13.2	6	0.022	—	—	10
Example 59	100	600	13.2	6	0.022	—	—	10
Example 60	100	600	13.2	6	0.022	—	—	—
Example 61	100	600	13.2	6	0.022	40	—	—
Example 62	100	600	13.2	6	0.022	—	50	—
Example 63	100	600	13.2	6	0.022	—	—	10

[0176] [Table 3-2]

	Particle diameter of function-exhibiting substance /nm	pH of coating liquid	Coating amount (dry) / μ m	Core material
Example 53	350	5.8	4.5	Prepreg
Example 54	350	5.8	4.5	Prepreg
Example 55	350	5.8	4.5	Prepreg
Example 56	1000	8.3	2.2	Prepreg
Example 57	1000	8.3	2.2	Prepreg
Example 58	2000	8.5	4.0	Prepreg
Example 59	2000	6.8	4.0	Prepreg
Example 60	-	6.8	4.0	Prepreg
Example 61	350	5.8	4.5	Prepreg
Example 62	1000	8.3	2.2	Prepreg
Example 63	2000	6.8	4.0	Prepreg

[0177] [Table 4-1]

	Composition				Function-exhibiting substance		
	A	B	C	x	m	n	o
	Parts by mass	Parts by mass	Parts by mass	Parts by mass	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition
Comparative Example 1	—	600	13.2	—	40	—	—
Comparative Example 2	100	—	13.2	—	40	—	—
Comparative Example 3	100	600	—	100	40	—	—
Comparative Example 4	100	600	—	100	—	—	—
Comparative Example 5	50	—	—	100	—	—	—
Comparative Example 6	50	50	—	100	—	—	—
Comparative Example 7	50	—	—	100	40	—	—
Comparative Example 8	50	50	—	100	40	—	—
Comparative Example 9	100	600	—	13.2	—	—	—

[0178] [Table 4-2]

	Particle diameter of function-exhibiting substance /nm	pH of coating liquid	Coating amount (dry) /μm	Core material
Comparative Example 1	350	5.1	4.5	Prepreg
Comparative Example 2	350	5.4	4.5	Prepreg
Comparative Example 3	350	5.9	4.5	Prepreg
Comparative Example 4	—	6.9	4.5	Prepreg
Comparative Example 5	—	6.5	4.5	Prepreg
Comparative Example 6	—	6.7	4.5	Prepreg
Comparative Example 7	350	5.9	4.5	Prepreg
Comparative Example 8	350	5.2	4.5	Prepreg
Comparative Example 9	—	6.8	4.5	Prepreg

[0179] [Table 5-1]

	Composition				Function-exhibiting composition				Blending ratio			Total		
	A	B	C		m	n	o		m:n	m:o	n:o	Total	Total	Total
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition						
Example 64	100	600	13.2	6	0.022	40	50	—	1.25			90		
Example 65	100	600	13.2	6	0.022	30	50	—	1.67			80		
Example 66	100	600	13.2	6	0.022	60	50	—	0.83			110		
Example 67	100	600	13.2	6	0.022	40	35	—	0.88			75		
Example 68	100	600	13.2	6	0.022	40	75	—	1.88			115		
Example 69	100	600	13.2	6	0.022	40	—	10		0.25			50	
Example 70	100	600	13.2	6	0.022	30	—	10		0.33			40	
Example 71	100	600	13.2	6	0.022	60	—	10		0.17			70	
Example 72	100	600	13.2	6	0.022	40	—	3		0.08			43	
Example 73	100	600	13.2	6	0.022	40	—	50		1.25			90	
Example 74	100	600	13.2	6	0.022	—	50	10			0.20			60
Example 75	100	600	13.2	6	0.022	—	35	10			0.29			45
Example 76	100	600	13.2	6	0.022	—	75	10			0.13			85
Example 77	100	600	13.2	6	0.022	—	50	3			0.06			53
Example 78	100	600	13.2	6	0.022	—	50	50			1.00			100

[0180] [Table 5-2]

	Particle diameter of function-exhibiting composition /nm			pH of coating liquid	Coating amount (dry) /μm	Core material
	m	n	o			
Example 64	350	1000	—	6.8	4.0	Prepreg
Example 65	350	1000	—	7.2	4.0	Prepreg
Example 66	350	1000	—	6.9	4.0	Prepreg
Example 67	350	1000	—	6.5	4.0	Prepreg
Example 68	350	1000	—	7.3	4.0	Prepreg
Example 69	350	—	2000	7.9	4.0	Prepreg
Example 70	350	—	2000	7.8	4.0	Prepreg
Example 71	350	—	2000	7.9	4.0	Prepreg
Example 72	350	—	2000	8.1	4.0	Prepreg
Example 73	350	—	2000	8.2	4.0	Prepreg
Example 74	—	1000	2000	8.1	4.0	Prepreg
Example 75	—	1000	2000	8.0	4.0	Prepreg
Example 76	—	1000	2000	8.2	4.0	Prepreg
Example 77	—	1000	2000	8.1	4.0	Prepreg
Example 78	—	1000	2000	8.3	4.0	Prepreg

[0181] [Table 6-1]

	Composition					Function-exhibiting composition					Blending ratio			Total
	A	B	C			m	n	o	m:m	m:n	m:o			
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition						
Example 79	100	600	13.2	6	0.022	20	40	10	1	2.00	0.50	70		
Example 80	100	600	13.2	6	0.022	10	40	10	1	4.00	1.00	60		
Example 81	100	600	13.2	6	0.022	60	40	10	1	0.67	0.17	110		
Example 82	100	600	13.2	6	0.022	20	20	10	1	1.00	0.50	50		
Example 83	100	600	13.2	6	0.022	20	70	10	1	3.50	0.50	100		
Example 84	100	600	13.2	6	0.022	20	40	5	1	2.00	0.25	65		
Example 85	100	600	13.2	6	0.022	20	40	60	1	2.00	3.00	120		
Example 86	100	600	13.2	6	0.022	20	40	10	1	2.00	0.50	70		
Example 87	100	600	13.2	6	0.022	20	40	10	1	2.00	0.50	70		
Example 88	100	600	13.2	6	0.022	20	40	10	1	2	0.5	70		
Example 89	100	600	13.2	6	0.022	20	40	10	1	2	0.5	70		
Example 90	100	600	13.2	6	0.022	20	40	10	1	2	0.5	70		
Example 91	100	600	13.2	6	0.022	20	40	10	1	2	0.5	70		
Example 92	100	600	13.2	6	0.022	20	40	10	1	2	0.5	70		
Example 93	100	600	13.2	6	0.022	20	40	10	1	2	0.5	70		
Example 94	100	600	13.2	6	0.022	20	40	10	1	2.00	0.50	70		
Example 95	100	600	13.2	6	0.022	10	40	10	1	4.00	1.00	60		
Example 96	100	600	13.2	6	0.022	60	40	10	1	0.67	0.17	110		

[0182] [Table 6-2]

	Particle diameter of function-exhibiting composition /nm			pH of coating liquid	Coating amount (dry) / μm	Core material
	m	n	o			
Example 79	350	1000	2000	7.5	4.0	Prepreg
Example 80	350	1000	2000	7.3	4.0	Prepreg
Example 81	350	1000	2000	7.6	4.0	Prepreg
Example 82	350	1000	2000	7.8	4.0	Prepreg
Example 83	350	1000	2000	7.4	4.0	Prepreg
Example 84	350	1000	2000	7.5	4.0	Prepreg
Example 85	350	1000	2000	7.6	4.0	Prepreg
Example 86	350	1000	2000	7.8	3.0	Prepreg
Example 87	350	1000	2000	7.5	5.0	Prepreg
Example 88	350	1000	2000	7.6	4.0	Prepreg
Example 89	350	1000	2000	7.8	4.0	Prepreg
Example 90	350	1000	2000	7.5	4.0	Prepreg
Example 91	350	1000	2000	7.4	4.0	Prepreg
Example 92	350	1000	2000	7.6	4.0	Prepreg
Example 93	350	1000	2000	7.7	4.0	Prepreg
Example 94	350	1000	2000	7.5	4.0	Impregnated Core Paper
Example 95	350	1000	2000	7.3	4.0	Impregnated Core Paper
Example 96	350	1000	2000	7.6	4.0	Impregnated Core Paper

[0183] [Table 7-1]

	Composition					Function-exhibiting composition					Blending ratio			Total
	A	B	C			m	n	o						
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	m:m	m:n	m:o			
Experiment Example 1	100	600	13.2	6	0.022	3	20	10	1	6.67	3.33	m+n+o		
Experiment Example 2	100	600	13.2	6	0.022	90	40	10	1	0.44	0.11	140		
Experiment Example 3	100	600	13.2	6	0.022	20	5	10	1	0.25	0.50	35		
Experiment Example 4	100	600	13.2	6	0.022	20	100	10	1	5.00	0.50	130		
Experiment Example 5	100	600	13.2	6	0.022	20	20	1	1	1.00	0.05	41		
Experiment Example 6	100	600	13.2	6	0.022	20	40	100	1	2.00	5.00	160		

[0184] [Table 7-2]

	Particle diameter of function-exhibiting composition /nm			pH of coating liquid	Coating amount (dry) /μm	Core material
	m	n	o			
Experiment Example 1	350	1000	2000	7.6	4.0	Prepreg
Experiment Example 2	350	1000	2000	7.5	4.0	Prepreg
Experiment Example 3	350	1000	2000	7.4	4.0	Prepreg
Experiment Example 4	350	1000	2000	7.3	4.0	Prepreg
Experiment Example 5	350	1000	2000	7.5	4.0	Prepreg
Experiment Example 6	350	1000	2000	7.6	4.0	Prepreg

[0185] [Table 8-1]

	Composition					Function-exhibiting composition		
	A	B	C			m	n	o
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition
Experiment Example 7	100	50	13.2	0.5	0.264	40	—	—
Experiment Example 8	100	1100	13.2	11	0.012	40	—	—
Experiment Example 9	100	600	5	6	0.008	40	—	—
Experiment Example 10	100	600	50	6	0.083	40	—	—

[0186] [Table 8-2]

	Particle diameter of function-exhibiting composition /nm	pH of coating liquid	Coating amount (dry) /μm	Core material
Experiment Example 7	350	7.8	4.5	Prepreg
Experiment Example 8	350	7.3	4.5	Prepreg
Experiment Example 9	350	7.1	4.5	Prepreg
Experiment Example 10	350	7.9	4.5	Prepreg

[0187]

[Table 9-1]

	Composition					Function-exhibiting composition			Blending ratio			Total		
	A	B	C				m	n	o	m:n	m:o	n:o	Total	Total
	Parts by mass	Parts by mass	Parts by mass	A:B	B:C	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition	Blending amount per 100 parts by mass of composition					
Experiment Example 11	100	600	13.2	6	0.022	20	50	—	—	2.50			70	
Experiment Example 12	100	600	13.2	6	0.022	100	50	—	—	0.50			150	
Experiment Example 13	100	600	13.2	6	0.022	40	20	—	—	0.50			60	
Experiment Example 14	100	600	13.2	6	0.022	40	85	—	—	2.13			125	
Experiment Example 15	100	600	13.2	6	0.022	20	—	10	10		0.50		30	
Experiment Example 16	100	600	13.2	6	0.022	150	—	10	10		0.07		160	
Experiment Example 17	100	600	13.2	6	0.022	30	—	1	1		0.03		31	
Experiment Example 18	100	600	13.2	6	0.022	40	—	80	80		2.00		120	
Experiment Example 19	100	600	13.2	6	0.022	—	5	10	10			2.00		15
Experiment Example 20	100	600	13.2	6	0.022	—	190	10	10			0.05		200
Experiment Example 21	100	600	13.2	6	0.022	—	30	0	0			0.00		30
Experiment Example 22	100	600	13.2	6	0.022	—	50	80	80			1.60		130

[0188] [Table 9-2]

	Particle diameter of function-exhibiting composition /nm			pH of coating liquid	Coating amount (dry)/ μm	Core material
	m	n	o			
Experiment Example 11	350	1000	-	6.9	4.0	Prepreg
Experiment Example 12	350	1000	-	7.0	4.0	Prepreg
Experiment Example 13	350	1000	-	7.2	4.0	Prepreg
Experiment Example 14	350	1000	-	7.3	4.0	Prepreg
Experiment Example 15	350	-	2000	7.5	4.0	Prepreg
Experiment Example 16	350	-	2000	7.9	4.0	Prepreg
Experiment Example 17	350	-	2000	7.8	4.0	Prepreg
Experiment Example 18	350	-	2000	7.5	4.0	Prepreg
Experiment Example 19	-	1000	2000	8.3	4.0	Prepreg
Experiment Example 20	-	1000	2000	8.1	4.0	Prepreg
Experiment Example 21	-	1000	2000	8.5	4.0	Prepreg
Experiment Example 22	-	1000	2000	8.6	4.0	Prepreg

[Evaluation Method]

Based on the following method, the melamine decorative laminates according to the above-described Examples, Experiment Examples, and Comparative Examples were evaluated in terms of appearance, functionality (odor reduction performance, antiviral performance, or anti-allergen performance), chemical resistance, and non-combustibility.

[0189] (1) Appearance

Appearance of each melamine decorative laminate was inspected based on

JIS K 6902:2007 “testing method for laminated thermosetting high-pressure decorative sheets”. In addition, an evaluation was made on whether a fingerprint is noticeable by touching the surface of the melamine decorative laminate by a palm for 5 seconds and thereafter removing the palm to visually observe the surface. The appearance of the melamine decorative laminate was evaluated in accordance with the following criteria.

[0190] ○ : no fault is present (there is no unevenness due to blushing on the surface, and a fingerprint is not noticeable).

[0191] △ 1: although there is a slight unevenness due to blushing on the surface, the wood conduit pattern part in the wood grain pattern of the decorative layer can be identified. A fingerprint is not noticeable.

[0192] △ 2: although there is no unevenness due to blushing on the surface, a fingerprint is slightly noticeable.

[0193] × : unevenness due to blushing occurs considerably on the surface, and the wood grain pattern of the decorative layer is so blurry that the wood conduit pattern part cannot be identified. A fingerprint is not noticeable.

[0194] It should be noted that a fingerprint is less noticeable when unevenness due to blushing occurs in the surface.

[0195] (2) Odor reduction Rate (%)

(2-1) Odor reduction performance with respect to hydrogen sulfide: a back surface and a side surface of a test specimen cut to a size of 100 mm×200 mm were covered with an aluminum tape such that an effective area of the test specimen is 200 cm². The test specimen was put in a Tedlar bag, and thereafter three liters of hydrogen sulfide gas was injected in the Tedlar bag such that a concentration of the hydrogen sulfide gas is 4 ppm therein. After elapse of 24 hours, a residual concentration of hydrogen sulfide was measured. Based on a value measured, a calculation was made to a total amount of odor reduction of hydrogen sulfide, which was defined as an odor reduction rate (%) of the hydrogen sulfide gas.

[0196] (2-2) Odor reduction performance with respect to ammonia: a back surface

and a side surface of a test specimen cut to a size of 100 mm×200 mm were covered with an aluminum tape such that an effective area of the test specimen is 200 cm². The test specimen was put in a Tedlar bag, and thereafter three liters of ammonia gas was injected in the Tedlar bag such that a concentration of the ammonia gas is 100 ppm therein. After elapse of 24 hours, a residual concentration of ammonia was measured. Based on a value measured, a calculation was made to a total amount of odor reduction of ammonia, which was defined as an odor reduction rate (%) of the ammonia gas.

[0197] (3) Phage Test on Antiviral Performance

Test virus: Bacteriophage Q β

Test Standard: JIS R 1756:2020 “Fine ceramics (advanced ceramics, advanced technical ceramics) -Determination of antiviral activity of photocatalytic materials under indoor lighting environment- Test method using bacteriophage Q-beta”

Measurement period of time: 24 hours

A test specimen cut to a size of 50 mm×50 mm was brought into contact with a test bacteria, the Bacteriophage Q β . After 24 hours, a test bacteria solution was collected and a virus infectivity titer was calculated. Based on the virus infectivity titer calculated, an antiviral activity was calculated in accordance with the following Formula.

[0198]
$$\text{Antiviral activity} = \log (\text{virus infectivity titer of unworked product}) - \log (\text{virus infectivity titer of worked product})$$

The unworked product means a melamine decorative laminate in which a cured layer made of the composition has not been formed. The worked product means the melamine decorative laminate according to each of Examples, Experiment Examples, and Comparative Examples.

[0199] (4) Anti-allergen Performance Ammonia

Test bacteria: mite allergens (Der fII), cedar pollen allergens (Cry jI)

Measurement period of time: 24 hours

Measurement method: ELISA method

A frame of 40 mm×40 mm was prepared, by adhesive agent, for a test specimen cut to a size of 50 mm×50 mm. An allergen solution of 0.4 ml prepared to have a fixed concentration was dropped within the frame and a film was closely adhered thereon.

[0200] After elapse of 24 hours, the solution was collected, and an allergen concentration of the solution was measured by ELISA method (Enzyme-Linked Immunosorbent Assay).

[0201] A calculation was made to a difference between the value measured and an allergen concentration of the unworked product, which was defined as an allergen reduction rate (%).

[0202] (5) Chemical Resistance

<Medicines Used>

q: 0.025% solution of Osvan liquid

r: 5.0% solution of cresol soap solution

s: 6.0% solution of sodium hypochlorite

t: 1% hydrochloric acid aqueous solution

u: 1% sodium hydroxide aqueous solution

<Test Method>

A test specimen was cleaned and dried. A test liquid of 0.2 ml was dropped onto the test specimen, which was left for 24 hours. Subsequently, the test liquid was rinsed with water. A change in the test specimen was observed with unaided eyes and evaluated by the evaluation method to be described below.

[0203] <Evaluation Method>

○ : no change is present.

△ : no erosion is present, but color tones and glossiness are changed.

× : erosion is present.

(6) Non-combustibility

A 20-minute heat release test using a cone calorimeter according to ISO 5660 was performed. In the evaluation method, evaluated as good (○) was a case where the total heat release was 8 MJ/m² or less, the maximum heat release

rate was continuously less than 200 kW/m^2 for 10 seconds or longer, and the test piece after the test had no fracture, crack, or the like penetrating to the back side. A case where at least one of these conditions was not satisfied was evaluated as poor (×).

[0204] Tables 10-1 through 18-2 show evaluation results.

[0205] [Table 10-1]

	Appearance	Functionality				
		Odor reduction rate %		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Example 1	○	82%	100%	-	-	-
Example 2	○	100%	100%	-	-	-
Example 3	○	71%	82%	-	-	-
Example 4	○	70%	90%	-	-	-
Example 5	○	70%	90%	-	-	-
Example 6	○	80%	90%	-	-	-
Example 7	○	83%	90%	-	-	-
Example 8	○	100%	100%	-	-	-
Example 9	○	78%	100%	-	-	-
Example 10	○	75%	81%	-	-	-
Example 11	○	100%	100%	-	-	-
Example 12	○	82%	100%	-	-	-
Example 13	○	82%	100%	-	-	-
Example 14	○	-	-	3.6	-	-
Example 15	○	-	-	2.8	-	-
Example 16	○	-	-	4.6	-	-
Example 17	○	-	-	2.9	-	-
Example 18	○	-	-	2.2	-	-
Example 19	○	-	-	3.5	-	-
Example 20	○	-	-	2.8	-	-
Example 21	○	-	-	2.5	-	-
Example 22	○	-	-	3.6	-	-
Example 23	○	-	-	-	92%	85%
Example 24	○	-	-	-	78%	72%
Example 25	○	-	-	-	99%	99%
Example 26	○	-	-	-	83%	87%
Example 27	○	-	-	-	88%	87%
Example 28	○	-	-	-	78%	78%
Example 29	○	-	-	-	99%	99%
Example 30	○	-	-	-	88%	78%
Example 31	○	-	-	-	91%	88%

[0206]

[Table 10-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Example 1	○	○	○	○	○	○
Example 2	○	○	○	○	○	○
Example 3	○	○	○	○	○	○
Example 4	○	○	○	○	○	○
Example 5	○	○	○	○	○	○
Example 6	○	○	○	○	○	○
Example 7	○	○	○	○	○	○
Example 8	○	○	○	○	○	○
Example 9	○	○	○	○	○	○
Example 10	○	○	○	○	○	○
Example 11	○	○	○	○	○	○
Example 12	○	○	○	○	○	○
Example 13	○	○	○	○	○	○
Example 14	○	○	○	○	○	○
Example 15	○	○	○	○	○	○
Example 16	○	○	○	○	○	○
Example 17	○	○	○	○	○	○
Example 18	○	○	○	○	○	○
Example 19	○	○	○	○	○	○
Example 20	○	○	○	○	○	○
Example 21	○	○	○	○	○	○
Example 22	○	○	○	○	○	○
Example 23	○	○	○	○	○	○
Example 24	○	○	○	○	○	○
Example 25	○	○	○	○	○	○
Example 26	○	○	○	○	○	○
Example 27	○	○	○	○	○	○
Example 28	○	○	○	○	○	○
Example 29	○	○	○	○	○	○
Example 30	○	○	○	○	○	○
Example 31	○	○	○	○	○	○

[0207] [Table 11-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Example 32	○	82%	100%	-	-	-
Example 33	○	100%	100%	-	-	-
Example 34	○	71%	82%	-	-	-
Example 35	○	100%	100%	-	-	-
Example 36	○	78%	100%	-	-	-
Example 37	○	75%	81%	-	-	-
Example 38	○	100%	100%	-	-	-
Example 39	○	-	-	3.6	-	-
Example 40	○	-	-	2.8	-	-
Example 41	○	-	-	4.6	-	-
Example 42	○	-	-	3.5	-	-
Example 43	○	-	-	2.8	-	-
Example 44	○	-	-	2.5	-	-
Example 45	○	-	-	3.6	-	-
Example 46	○	-	-	-	92%	85%
Example 47	○	-	-	-	78%	72%
Example 48	○	-	-	-	99%	99%
Example 49	○	-	-	-	83%	87%
Example 50	○	-	-	-	88%	87%
Example 51	○	-	-	-	78%	78%
Example 52	○	-	-	-	99%	99%

[0208] [Table 11-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Example 32	○	○	○	○	○	—
Example 33	○	○	○	○	○	—
Example 34	○	○	○	○	○	—
Example 35	○	○	○	○	○	—
Example 36	○	○	○	○	○	—
Example 37	○	○	○	○	○	—
Example 38	○	○	○	○	○	—
Example 39	○	○	○	○	○	—
Example 40	○	○	○	○	○	—
Example 41	○	○	○	○	○	—
Example 42	○	○	○	○	○	—
Example 43	○	○	○	○	○	—
Example 44	○	○	○	○	○	—
Example 45	○	○	○	○	○	—
Example 46	○	○	○	○	○	—
Example 47	○	○	○	○	○	—
Example 48	○	○	○	○	○	—
Example 49	○	○	○	○	○	—
Example 50	○	○	○	○	○	—
Example 51	○	○	○	○	○	—
Example 52	○	○	○	○	○	—

[0209]

[Table 12-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Example 53	○	78%	95%	-	-	-
Example 54	○	72%	96%	-	-	-
Example 55	○	74%	92%	-	-	-
Example 56	○	-	-	2.8	-	-
Example 57	○	-	-	2.5	-	-
Example 58	○	-	-	-	78%	72%
Example 59	○	-	-	-	72%	79%
Example 60	○	-	-	-	-	-
Example 61	○	72%	75%	-	-	—
Example 62	○	-	-	2.2	-	-
Example 63	○	-	-	-	79%	81%

[0210] [Table 12-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Example 53	○	○	○	○	○	○
Example 54	○	○	○	○	○	○
Example 55	○	○	○	○	○	○
Example 56	○	○	○	○	○	○
Example 57	○	○	○	○	○	○
Example 58	○	○	○	○	○	—
Example 59	○	○	○	○	○	—
Example 60	○	○	○	○	○	○
Example 61	○	○	○	○	○	○
Example 62	○	○	○	○	○	○
Example 63	○	○	○	○	○	○

[0211] [Table 13-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Comparative Example 1	○	25%	23%	-	-	-
Comparative Example 2	○	22%	33%	-	-	-
Comparative Example 3	○	12%	22%	-	-	-
Comparative Example 4	○	-	-	-	-	-
Comparative Example 5	○	-	-	-	-	-
Comparative Example 6	○	-	-	-	-	-
Comparative Example 7	○	25%	33%	-	-	-
Comparative Example 8	○	32%	45%	-	-	-
Comparative Example 9	○	-	-	-	-	-

[0212]

[Table 13-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Comparative Example 1	△	△	△	×	△	○
Comparative Example 2	△	△	×	×	△	○
Comparative Example 3	△	△	×	×	○	○
Comparative Example 4	△	△	×	×	○	○
Comparative Example 5	○	○	×	×	×	○
Comparative Example 6	○	○	×	×	×	○
Comparative Example 7	○	○	×	×	×	○
Comparative Example 8	○	○	×	×	×	○
Comparative Example 9	○	○	×	×	×	○

[0213] [Table 14-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Example 64	○	92%	100%	3.2	-	-
Example 65	○	81%	98%	2.8	-	-
Example 66	○	100%	100%	2.9	-	-
Example 67	○	78%	88%	2.5	-	-
Example 68	○	85%	91%	3.9	-	-
Example 69	○	95%	100%	-	78%	88%
Example 70	○	81%	92%	-	88%	89%
Example 71	○	100%	100%	-	75%	81%
Example 72	○	89%	95%	-	73%	75%
Example 73	○	89%	93%	-	98%	98%
Example 74	○	-	-	3.5	76%	82%
Example 75	○	-	-	2.6	88%	85%
Example 76	○	-	-	3.9	75%	81%
Example 77	○	-	-	3.2	72%	78%
Example 78	○	-	-	3.1	95%	98%

[0214]

[Table 14-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Example 64	○	○	○	○	○	○
Example 65	○	○	○	○	○	○
Example 66	○	○	○	○	○	○
Example 67	○	○	○	○	○	○
Example 68	○	○	○	○	○	○
Example 69	○	○	○	○	○	○
Example 70	○	○	○	○	○	○
Example 71	○	○	○	○	○	○
Example 72	○	○	○	○	○	○
Example 73	○	○	○	○	○	○
Example 74	○	○	○	○	○	○
Example 75	○	○	○	○	○	○
Example 76	○	○	○	○	○	○
Example 77	○	○	○	○	○	○
Example 78	○	○	○	○	○	○

[0215]

[Table 15-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Example 79	○	98%	100%	3.8	88%	95%
Example 80	○	85%	88%	4.0	92%	98%
Example 81	○	100%	100%	2.7	82%	87%
Example 82	○	100%	100%	2.5	95%	98%
Example 83	○	95%	98%	4.2	78%	84%
Example 84	○	100%	100%	3.5	95%	98%
Example 85	○	78%	88%	3.3	79%	82%
Example 86	○	82%	88%	2.6	77%	81%
Example 87	○	100%	100%	4.1	95%	99%
Example 88	○	88%	91%	2.8	75%	86%
Example 89	○	78%	88%	2.6	78%	78%
Example 90	○	72%	81%	2.3	79%	81%
Example 91	○	75%	78%	2.5	75%	82%
Example 92	○	76%	73%	2.4	74%	79%
Example 93	○	78%	75%	2.3	73%	82%
Example 94	○	100%	100%	4.1	95%	98%
Example 95	○	98%	98%	3.5	95%	98%
Example 96	○	100%	100%	2.8	85%	92%

[0216]

[Table 15-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Example 79	○	○	○	○	○	○
Example 80	○	○	○	○	○	○
Example 81	○	○	○	○	○	○
Example 82	○	○	○	○	○	○
Example 83	○	○	○	○	○	○
Example 84	○	○	○	○	○	○
Example 85	○	○	○	○	○	○
Example 86	○	○	○	○	○	○
Example 87	○	○	○	○	○	○
Example 88	○	○	○	○	○	○
Example 89	○	○	○	○	○	○
Example 90	○	○	○	○	○	○
Example 91	○	○	○	○	○	○
Example 92	○	○	○	○	○	○
Example 93	○	○	○	○	○	○
Example 94	○	○	○	○	○	○
Example 95	○	○	○	○	○	○
Example 96	○	○	○	○	○	○

[0217]

[Table 16-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Experiment Example 1	○	45%	68%	3.5	89%	92%
Experiment Example 2	△1	100%	100%	3.8	92%	98%
Experiment Example 3	○	98%	100%	0.7	89%	92%
Experiment Example 4	△1	78%	85%	1.7	78%	82%
Experiment Example 5	○	98%	100%	3.8	11%	12%
Experiment Example 6	△1	84%	95%	2.8	98%	98%

[0218] [Table 16-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Experiment Example 1	○	○	○	○	○	○
Experiment Example 2	○	○	○	○	○	○
Experiment Example 3	○	○	○	○	○	○
Experiment Example 4	○	○	○	×	○	○
Experiment Example 5	○	○	○	○	○	○
Experiment Example 6	○	○	×	○	○	○

[0219] [Table 17-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Experiment Example 7	○	33%	25%	-	-	-
Experiment Example 8	△1	68%	75%	-	-	-
Experiment Example 9	△2	44%	32%	-	-	-
Experiment Example 10	△1	32%	51%	-	-	-

[0220] [Table 17-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Experiment Example 7	○	○	×	×	○	○
Experiment Example 8	○	○	×	×	×	○
Experiment Example 9	○	○	×	×	○	○
Experiment Example 10	○	○	×	×	×	○

[0221] [Table 18-1]

	Appearance	Functionality				
		Odor reduction rate/%		Phage test on activity of antiviral performance	Anti-allergen performance	
		Hydrogen sulfide	Ammonia		Cedar pollen allergens	Mite allergens
Experiment Example 11	○	65%	71%	3.3	-	-
Experiment Example 12	△1	100%	100%	2.5	-	-
Experiment Example 13	○	78%	85%	1.7	-	-
Experiment Example 14	△1	72%	81%	4.0	-	-
Experiment Example 15	○	55%	68%	-	88%	98%
Experiment Example 16	△1	100%	100%	-	78%	86%
Experiment Example 17	○	95%	100%	-	5%	8%
Experiment Example 18	△1	82%	100%	-	98%	99%
Experiment Example 19	○	-	-	0.7	78%	88%
Experiment Example 20	△1	-	-	4.1	72%	78%
Experiment Example 21	○	-	-	2.8	4%	10%
Experiment Example 22	△1	-	-	2.9	98%	98%

[0222]

[Table 18-2]

	Chemical resistance					Non-combustibility
	q	r	s	t	u	
Experiment Example 11	○	○	○	○	○	○
Experiment Example 12	○	○	○	○	○	○
Experiment Example 13	○	○	○	○	○	○
Experiment Example 14	○	○	×	○	○	○
Experiment Example 15	○	○	○	○	○	○
Experiment Example 16	○	○	○	○	○	○
Experiment Example 17	○	○	○	○	○	○
Experiment Example 18	○	○	×	○	○	○
Experiment Example 19	○	○	○	○	○	○
Experiment Example 20	○	○	○	○	○	○
Experiment Example 21	○	○	○	○	○	○
Experiment Example 22	○	○	×	○	○	○

[Consideration]

As shown in Table 16-1, in Experiment Example 1, the blending amount of the odor-reducing substance (m) was small and therefore, the odor reduction performance was slightly worsened. In Experiment Example 2, the blending amount of the odor-reducing substance (m) was large and therefore, minor unevenness due to blushing occurred in the appearance (Δ 1). In Experiment

Example 3, the blending amount of the antiviral substance (n) was small and therefore, the antiviral performance was slightly worsened. In Experiment Example 4, the blending amount of the antiviral substance (n) was large and therefore, minor unevenness due to blushing occurred in the appearance ($\Delta 1$). In Experiment Example 5, the blending amount of the anti-allergen substance (o) was small and therefore, the anti-allergen performance was slightly worsened. In Experiment Example 6, the blending amount of the anti-allergen substance (o) was large and therefore, minor unevenness due to blushing occurred in the appearance ($\Delta 1$).

[0223] As shown in Table 17-1, in Experiment Example 7, although the functional composition included the components (A), (B), and (C), the blending amount of the component (B) was less than 0.5 parts by mass with respect to 1 part by mass in solid content of the component (A). The odor reduction performance was slightly worsened and the chemical resistance was also slightly worsened. In Experiment Example 8, although the functional composition included the components (A), (B), and (C), the blending amount of the component (B) exceeded 12 parts by mass with respect to 1 part by mass in solid content of the components (A). Although a fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\Delta 1$). In Example Experiment 9, although the functional composition included the components (A), (B), and (C), the blending amount of the component (C) was less than 0.005 parts by mass with respect to 1 part by mass in solid content of the component (B). Although unevenness due to blushing did not occur, a fingerprint was slightly noticeable ($\Delta 2$). In Experiment Example 10, although the functional composition included the components (A), (B), and (C), the blending amount of the component (C) exceeded 0.3 parts by mass with respect to 1 part by mass in solid content of the component (B). Although a fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\Delta 1$).

[0224] As shown in Table 18-1, in Experiment Example 11, the odor reduction performance was slightly worsened. In Experiment Example 12, although a

fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\triangle 1$). In Experiment Example 13, the antiviral performance was slightly worsened. In Experiment Example 14, although a fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\triangle 1$). In Experiment Example 15, the odor reduction performance was slightly worsened. In Experiment Example 16, although a fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\triangle 1$). In Experiment Example 17, the anti-allergen performance was slightly worsened. In Experiment Example 18, although a fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\triangle 1$). In Experiment Example 19, the antiviral performance was slightly worsened. In Experiment Example 20, although a fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\triangle 1$). In Experiment Example 21, the anti-allergen performance was slightly worsened. In Experiment Example 22, although a fingerprint was not noticeable in the appearance, minor unevenness due to blushing occurred ($\triangle 1$).

CLAIMS

1. A composition comprising:
a hydrolytic condensate of silicon alkoxide (A);
an organo silica sol dispersed in a hydrophilic solvent (B); and
an acrylic polymer having a hydrophilic group and a hydrophobic group (C).
2. The composition according to claim 1, wherein the composition includes at least one substance selected from a group consisting of an odor-reducing substance (m), an antiviral substance (n), and an anti-allergen substance (o).
3. The composition according to claim 2,
wherein the composition includes the odor-reducing substance (m), and
wherein a blending amount of the odor-reducing substance (m) in the composition is 30 to 60 parts by mass with respect to 100 parts by mass in solid content of the composition.
4. The composition according to claim 2 or 3,
wherein the composition includes the antiviral substance (n), and
wherein a blending amount of the antiviral substance (n) in the composition is 35 to 75 parts by mass with respect to 100 parts by mass in solid content of the composition.
5. The composition according to any one of claims 2 to 4,
wherein the composition includes the anti-allergen substance (o), and
wherein a blending amount of the anti-allergen substance (o) in the composition is 3 to 50 parts by mass with respect to 100 parts by mass in solid content of the composition.
6. The composition according to any one of claims 2 to 5,

wherein the composition includes the odor-reducing substance (m), and

wherein the odor-reducing substance (m) includes an odor-reducing substance of chemical adsorption type.

7. The composition according to claim 6, wherein the odor-reducing substance of the chemical adsorption type includes at least one selected from a group consisting of zinc oxide, silica, zeolite, copper oxide, and zirconium oxide.

8. The composition according to any one of claims 2 to 7,

wherein the composition includes the antiviral substance (n), and

wherein the antiviral substance (n) includes at least one selected from a group consisting of a triazine-thiazole-imidazole-based substance, amino-modified polyvinyl alcohol, and an amino-modified acrylic polymer.

9. The composition according to any one of claims 2 to 8,

wherein the composition includes the anti-allergen substance (o), and

wherein the anti-allergen substance (o) includes a composite of an anion-modified organic compound and a carrier.

10. The functional composition according to claim 9, wherein the anion-modified organic compound includes at least one selected from a group consisting of anion-modified linear alkane and anion-modified polyvinyl alcohol.

11. The composition according to claim 9 or 10, wherein the carrier includes at least one selected from a group consisting of styrene particles and silver oxide particles.

12. The composition according to any one of claims 1 to 11, wherein the composition is used for a melamine decorative laminate.

13. A transfer sheet comprising:

a sheet-like base material; and

a cured layer made of the composition according to any one of claims 1 to 12, the cured layer being formed on one side surface of the sheet-like base material.

14. A melamine decorative laminate comprising:

a core layer;

a decorative layer including a cured product made of melamine resin; and

a cured layer made of the composition according to any one of claims 1 to 12 in this order.

15. A method of producing a melamine decorative laminate, the method comprising:

providing the melamine decorative laminate with a core layer, a decorative layer including a cured product made of melamine resin, and a front surface layer in this order; and

curing the composition according to any one of claims 1 to 12 to thereby form the front surface layer.