

DESCRIPTION

TITLE OF INVENTION: Pressure-Sensitive Adhesive Composition, Pressure-Sensitive Adhesive Layer and Pressure-Sensitive Adhesive Sheet

5

TECHNICAL FIELD

[0001]

The present invention relates to a pressure-sensitive adhesive composition, a pressure-sensitive adhesive layer containing the pressure-sensitive adhesive composition and
10 a pressure-sensitive adhesive sheet having the pressure-sensitive adhesive layer.

BACKGROUND ART

[0002]

As pressure-sensitive adhesive tapes, transparent tapes have been preferably used
15 because it is easy to see the position in the processing steps and in the operations such as adhesion. For the purpose of changing the design or improving the design and the visibility or for another purpose, colored pressure-sensitive adhesive tapes are also used.

[0003]

For example, PTL 1 describes a colored pressure-sensitive adhesive sheet in which
20 the thickness of the pressure-sensitive adhesive sheet is reduced and which has properties of achieving a design or decoration of an adherend or hiding a defect of an adherend with the masking property.

CITATION LIST

25 PATENT LITERATURE

[0004]

PTL 1: JP-A-2013-245298

SUMMARY OF INVENTION

30 TECHNICAL PROBLEM

[0005]

The pressure-sensitive adhesive sheet described in PTL 1 is colored by adding a dye to the pressure-sensitive adhesive layer. Therefore, the formed pressure-sensitive adhesive

sheet has already been colored, and the pressure-sensitive adhesive sheet cannot be colored at timing such as after the step of adhesion of the sheet.

[0006]

Therefore, a problem of the invention is to provide a pressure-sensitive adhesive composition which can be changed in the color or colored at any timing and a pressure-sensitive adhesive layer and a pressure-sensitive adhesive sheet using the pressure-sensitive adhesive composition.

SOLUTION TO PROBLEM

[0007]

The present inventors have conducted extensive studies for the purpose of providing a pressure-sensitive adhesive composition and the like which can be changed in the color or colored at any timing. As a result, the inventors have arrived at an idea of using a leuco dye which is colored through reaction with an acid and a photoacid generator which generates an acid by irradiation with an active energy ray in combination for a pressure-sensitive adhesive composition. That is, the inventors have found that a pressure-sensitive adhesive composition containing a leuco dye and a photoacid generator can be changed in the color or colored at any timing by irradiating with an active energy ray, and the invention has thus been completed.

[0008]

In an embodiment, the invention relates to a pressure-sensitive adhesive composition containing a base polymer, a leuco dye and a photoacid generator.

[0009]

In an embodiment of the invention, the absorption wavelength of the leuco dye preferably changes with the pH.

[0010]

In an embodiment of the invention, the pressure-sensitive adhesive composition preferably contains 0.1 to 30 parts by mass of the leuco dye per 100 parts by mass of the base polymer.

[0011]

In an embodiment of the invention, the leuco dye is preferably at least one dye selected from the group consisting of a phthalide dye and a fluoran dye.

[0012]

In an embodiment of the invention, the pressure-sensitive adhesive composition preferably contains 0.1 to 30 parts by mass of the photoacid generator per 100 parts by mass of the base polymer.

[0013]

5 In an embodiment of the invention, the photoacid generator is preferably at least one compound selected from the group consisting of a sulfonium salt compound, an iodonium salt compound and an aromatic N-oxyimidosulfonate.

[0014]

10 In an embodiment of the invention, the base polymer preferably contains an acrylic polymer.

[0015]

In an embodiment of the invention, the pressure-sensitive adhesive composition may change in the color by irradiation with an active energy ray.

[0016]

15 In an embodiment of the invention, the pressure-sensitive adhesive composition may be colored by irradiation with an active energy ray.

[0017]

In an embodiment, the invention relates to a pressure-sensitive adhesive layer containing the pressure-sensitive adhesive composition.

20 [0018]

In an embodiment, the invention relates to a pressure-sensitive adhesive sheet having the pressure-sensitive adhesive layer.

[0019]

25 In an embodiment of the invention, the pressure-sensitive adhesive sheet may have a UV-absorbing layer on one surface of the pressure-sensitive adhesive layer.

[0020]

In an embodiment of the invention, the UV-absorbing layer may be a pressure-sensitive adhesive layer containing a UV absorber.

[0021]

30 In an embodiment of the invention, the pressure-sensitive adhesive layer in the pressure-sensitive adhesive sheet may be formed on a base material.

ADVANTAGEOUS EFFECTS OF INVENTION

[0022]

The pressure-sensitive adhesive composition in an embodiment of the invention can be changed in the color or colored by irradiation with an active energy ray. Accordingly, a pressure-sensitive adhesive layer or a pressure-sensitive adhesive sheet using the pressure-sensitive adhesive composition can be changed in the color or colored at any timing such as after adhesion.

BRIEF DESCRIPTION OF DRAWINGS

[0023]

[Fig. 1] Fig. 1 is a figure showing an example of the oxidation-reduction reaction of the leuco dye in an embodiment of the invention.

[Fig. 2] Fig. 2 is an example of the schematic cross section of the pressure-sensitive adhesive layer according to an embodiment of the invention.

[Fig. 3] Fig. 3 is an example of the schematic cross section of the pressure-sensitive adhesive sheet according to an embodiment of the invention.

[Fig. 4] Fig. 4 is an example of the schematic cross section of the pressure-sensitive adhesive sheet according to an embodiment of the invention.

[Fig. 5] Fig. 5 is an example of the schematic cross section of the pressure-sensitive adhesive sheet according to an embodiment of the invention.

[Fig. 6] Fig. 6 is an example of the schematic cross section of the pressure-sensitive adhesive sheet according to an embodiment of the invention.

DESCRIPTION OF EMBODIMENTS

[0024]

Embodiments of the invention are explained in detail below. In this regard, the invention is not limited to the embodiments explained below.

[0025]

<Pressure-Sensitive Adhesive Composition>

The pressure-sensitive adhesive composition in an embodiment of the invention is characterized by containing a base polymer, a leuco dye and a photoacid generator.

[0026]

According to a pressure-sensitive adhesive layer or a pressure-sensitive adhesive sheet obtained using the pressure-sensitive adhesive composition, an acid is generated from

the photoacid generator by irradiation with an active energy ray, and the pressure-sensitive adhesive layer or the pressure-sensitive adhesive sheet can be changed in the color or colored through the reaction of the acid and the leuco dye. That is, a pressure-sensitive adhesive layer or a pressure-sensitive adhesive sheet obtained using the pressure-sensitive adhesive composition can be changed in the color or colored by irradiation with an active energy ray and can be thus changed in the color or colored at any timing such as after adhesion.
[0027]

In the present specification, “A to B” indicating a range means “A or more and B or less”. Moreover, in the present specification, “weight” and “mass”, “weight%” and “mass%” and “parts by weight” and “parts by mass” are each considered synonyms.
[0028]

In the present specification, “to change in the color” means that the color changes after by irradiation with an active energy ray and is a concept which includes that the color disappears by irradiation with an active energy ray, that a color develops by irradiation with an active energy ray and that the original color changes into a different color by irradiation with an active energy ray.

Moreover, in the present specification, “to color” means that a color develops after irradiation with an active energy ray and is a concept which includes that a color develops by irradiation with an active energy ray and that the original color changes into a different color by irradiation with an active energy ray and which does not include that the color disappears by irradiation with an active energy ray.
[0029]

The components that the pressure-sensitive adhesive composition contains are explained in detail below.

[0030]

(Base Polymer)

In the pressure-sensitive adhesive composition in an embodiment of the invention, the base polymer constituting the pressure-sensitive adhesive composition is not particularly limited, and a known polymer used for a pressure-sensitive adhesive can be used. Examples thereof include an acrylic polymer, a rubber-based polymer, a vinyl alkyl ether-based polymer, a silicone-based polymer, a polyester-based polymer, a polyamide-based polymer, a urethane-based polymer, a fluoropolymer, an epoxy-based polymer and the like. Of the examples, an acrylic polymer and a rubber-based polymer are preferable in view of the

adhesiveness. Moreover, because the change in appearance after color change or coloration is remarkable, an acrylic polymer with high transparency is more preferable. A kind of the polymers may be used alone, or a combination of two or more kinds thereof may be used.

[0031]

5 An embodiment in which an acrylic polymer is contained as the base polymer in the pressure-sensitive adhesive composition in an embodiment of the invention is mainly explained below, but the invention is not limited to the embodiment.

[0032]

The pressure-sensitive adhesive composition in an embodiment of the invention can
10 contain an acrylic polymer as the base polymer. The pressure-sensitive adhesive composition can be typically an acrylic pressure-sensitive adhesive composition containing an acrylic polymer as the main component. An acrylic pressure-sensitive adhesive composition has excellent transparency.

[0033]

15 For example, the pressure-sensitive adhesive composition in an embodiment of the invention preferably contains, as the base polymer, an acrylic polymer composed of monomer components containing an alkyl (meth)acrylic acid ester having a linear or branched alkyl group having 1 or more and 20 or less carbon atoms at the ester terminal in a percentage of 40 weight% or more.

20 [0034]

An alkyl (meth)acrylic acid ester having an alkyl group having X or more and Y or less carbon atoms at the ester terminal is sometimes referred to as “C_{X-Y} alkyl (met)acrylic acid ester” below. Because the balance of the characteristics is easily kept, the percentage of the C₁₋₂₀ alkyl (meth)acrylic acid ester in all the monomer components of the acrylic polymer
25 according to an aspect is suitably more than 50 weight%, may be, for example, 55 weight% or more, may be 60 weight% or more and may be 70 weight% or more.

[0035]

For the same reason, the percentage of the C₁₋₂₀ alkyl (meth)acrylic acid ester in the monomer components may be, for example, 99.9 weight% or less, may be 99.5 weight% or
30 less and may be 99 weight% or less. The percentage of the C₁₋₂₀ alkyl (meth)acrylic acid ester in all the monomer components of the acrylic polymer according to another aspect may be, for example, 98 weight% or less, may be 95 weight% or less to improve the cohesiveness of the pressure-sensitive adhesive layer, may be 85 weight% or less (for example, less than 80

weight%), may be 70 weight% or less and may be 60 weight% or less.

[0036]

Nonlimiting specific examples of the C₁₋₂₀ alkyl (meth)acrylic acid ester include methyl (meth)acrylate, ethyl (meth)acrylate, propyl (meth)acrylate, isopropyl (meth)acrylate, 5 n-butyl (meth)acrylate, isobutyl (meth)acrylate, s-butyl (meth)acrylate, t-butyl (meth)acrylate, pentyl (meth)acrylate, isopentyl (meth)acrylate, hexyl (meth)acrylate, heptyl (meth)acrylate, octyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, isooctyl (meth)acrylate, nonyl (meth)acrylate, isononyl (meth)acrylate, decyl (meth)acrylate, isodecyl (meth)acrylate, undecyl (meth)acrylate, dodecyl (meth)acrylate, tridecyl (meth)acrylate, tetradecyl 10 (meth)acrylate, pentadecyl (meth)acrylate, hexadecyl (meth)acrylate, heptadecyl (meth)acrylate, stearyl (meth)acrylate, isostearyl (meth)acrylate, nonadecyl (meth)acrylate, eicosyl (meth)acrylate and the like.

[0037]

Of the examples, at least a C₄₋₂₀ alkyl (meth)acrylic acid ester is preferably used, 15 and at least a C₄₋₁₈ alkyl (meth)acrylic acid ester is more preferably used. For example, one of or both of n-butyl acrylate (BA) and 2-ethylhexyl acrylate (2EHA) are preferably contained as the monomer component, and an acrylic pressure-sensitive adhesive containing at least 2EHA is particularly preferable. Other examples of the C₄₋₂₀ alkyl (meth)acrylic acid ester which can be preferably used include isononyl acrylate, n-butyl methacrylate (BMA), 2- 20 ethylhexyl methacrylate (2EHMA), isostearyl acrylate (iSTA) and the like.

[0038]

In some aspects, the monomer components constituting the acrylic polymer can contain a C₄₋₁₈ alkyl (meth)acrylic acid ester in a percentage of 40 weight% or more. The percentage of the C₄₋₁₈ alkyl (meth)acrylic acid ester in the monomer components may be, for 25 example, 50 weight% or more, may be 60 weight% or more and may be 65 weight% or more. The monomer components may contain a C₆₋₁₈ alkyl (meth)acrylic acid ester in a percentage of any of the lower limits above or more.

[0039]

To improve the cohesiveness of the pressure-sensitive adhesive layer, the 30 percentage of the C₄₋₁₈ alkyl (meth)acrylic acid ester in the monomer components is generally suitably 99.5 weight% or less, may be 95 weight% or less, may be 85 weight% or less and may be 75 weight% or less. The monomer components may contain a C₆₋₁₈ alkyl (meth)acrylic acid ester in a percentage of any of the upper limits above or less.

[0040]

The monomer components constituting the acrylic polymer may contain, in addition to the alkyl (meth)acrylic acid ester, another monomer (a copolymerizable monomer) which can be copolymerized with the alkyl (meth)acrylic acid ester according to need. As the
5 copolymerizable monomer, a monomer having a polar group (for example, a carboxy group, a hydroxyl group, a nitrogen atom-containing ring or the like) or a monomer in which the glass transition temperature of the homopolymer is relatively high (for example, 10°C or higher) can be preferably used. A monomer having a polar group can contribute to introduction of a crosslinking site to the acrylic polymer or improvement of the cohesive force of the pressure-
10 sensitive adhesive. A kind of the copolymerizable monomers alone or a combination of two or more kinds thereof can be used.

[0041]

Nonlimiting specific examples of the copolymerizable monomer include the following monomers.

[0042]

Carboxy group-containing monomers: for example, acrylic acid, methacrylic acid, carboxyethyl acrylate, carboxypentyl acrylate, itaconic acid, maleic acid, fumaric acid, crotonic acid, isocrotonic acid and the like.

[0043]

20 Acid anhydride group-containing monomers: for example, maleic anhydride and itaconic anhydride.

[0044]

Hydroxyl group-containing monomers: for example, hydroxyalkyl (meth)acrylates such as 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 2-hydroxybutyl
25 (meth)acrylate, 3-hydroxypropyl (meth)acrylate, 4-hydroxybutyl (meth)acrylate, 6-hydroxyhexyl (meth)acrylate, 8-hydroxyoctyl (meth)acrylate, 10-hydroxydecyl (meth)acrylate, 12-hydroxylauryl (meth)acrylate and (4-hydroxymethylcyclohexyl)methyl (meth)acrylate and the like.

[0045]

30 Sulfonic acid group- or phosphoric acid group-containing monomers: for example, styrene sulfonic acid, allyl sulfonic acid, sodium vinylsulfonate, 2-(meth)acrylamide-2-methylpropane sulfonic acid, (meth)acrylamide propane sulfonic acid, sulfopropyl (meth)acrylate, (meth)acryloyloxynaphthalene sulfonic acid, 2-hydroxyethylacryloyl

phosphate and the like.

[0046]

Epoxy group-containing monomers: for example, epoxy group-containing acrylates such as glycidyl (meth)acrylate and (meth)acrylic acid-2-ethylglycidyl ether, allyl glycidyl ether, (meth)acrylic acid glycidyl ether and the like.

[0047]

Cyano group-containing monomers: for example, acrylonitrile, methacrylonitrile and the like.

[0048]

Isocyanate group-containing monomers: for example, 2-isocyanatoethyl (meth)acrylate and the like.

[0049]

Amide group-containing monomers: for example, (meth)acrylamide; N,N-dialkyl (meth)acrylamides such as N,N-dimethyl (meth)acrylamide, N,N-diethyl (meth)acrylamide, N,N-dipropyl (meth)acrylamide, N,N-diisopropyl (meth)acrylamide, N,N-di(n-butyl) (meth)acrylamide and N,N-di(t-butyl) (meth)acrylamide; N-alkyl (meth)acrylamides such as N-ethyl (meth)acrylamide, N-isopropyl (meth)acrylamide, N-butyl (meth)acrylamide and N-n-butyl (meth)acrylamide; N-vinylcarboxylic acid amides such as N-vinylacetamide; monomers having a hydroxyl group and an amide group, for example, N-hydroxyalkyl (meth)acrylamides such as N-(2-hydroxyethyl) (meth)acrylamide, N-(2-hydroxypropyl) (meth)acrylamide, N-(1-hydroxypropyl) (meth)acrylamide, N-(3-hydroxypropyl) (meth)acrylamide, N-(2-hydroxybutyl) (meth)acrylamide, N-(3-hydroxybutyl) (meth)acrylamide and N-(4-hydroxybutyl) (meth)acrylamide; monomers having an alkoxy group and an amide group, for example, N-alkoxyalkyl (meth)acrylamides such as N-methoxymethyl (meth)acrylamide, N-methoxyethyl (meth)acrylamide and N-butoxymethyl (meth)acrylamide; and others such as N,N-dimethylaminopropyl (meth)acrylamide and N-(meth)acryloylmorpholine.

[0050]

Amino group-containing monomers: for example, aminoethyl (meth)acrylate, N,N-dimethylaminoethyl (meth)acrylate and t-butylaminoethyl (meth)acrylate.

[0051]

Monomers having an epoxy group: for example, glycidyl (meth)acrylate, methylglycidyl (meth)acrylate and allyl glycidyl ether.

[0052]

Monomers having a nitrogen atom-containing ring: for example, N-vinyl-2-pyrrolidone, N-methylvinylpyrrolidone, N-vinylpyridine, N-vinylpiperidone, N-vinylpyrimidine, N-vinylpiperazine, N-vinylpyrazine, N-vinylpyrrole, N-vinylimidazole, N-vinylloxazole, N-(meth)acryloyl-2-pyrrolidone, N-(meth)acryloylpiperidine, N-(meth)acryloylpyrrolidone, N-vinylmorpholine, N-vinyl-3-morpholinone, N-vinyl-2-caprolactam, N-vinyl-1,3-oxazin-2-one, N-vinyl-3,5-morpholinedione, N-vinylpyrazole, N-vinylisoxazole, N-vinylthiazole, N-vinylisothiazole, N-vinylpyridazine and the like (for example, lactams such as N-vinyl-2-caprolactam).

10 [0053]

Monomers having a succinimide skeleton: for example, N-(meth)acryloyloxymethylene succinimide, N-(meth)acryloyl-6-oxyhexamethylene succinimide, N-(meth)acryloyl-8-oxyhexamethylene succinimide and the like.

[0054]

15 Maleimides: for example, N-cyclohexylmaleimide, N-isopropylmaleimide, N-laurylmaleimide, N-phenylmaleimide and the like.

[0055]

Itaconimides: for example, N-methylitaconimide, N-ethylitaconimide, N-butylitaconimide, N-octylitaconimide, N-2-ethylhexylitaconimide, N-cyclohexylitaconimide, N-laurylitaconimide and the like.

20 [0056]

Aminoalkyl (meth)acrylates: for example, aminoethyl (meth)acrylate, N,N-dimethylaminoethyl (meth)acrylate, N,N-diethylaminoethyl (meth)acrylate and t-butylaminoethyl (meth)acrylate.

25 [0057]

Alkoxy group-containing monomers: for example, alkoxyalkyl (meth)acrylates such as 2-methoxyethyl (meth)acrylate, 3-methoxypropyl (meth)acrylate, 2-ethoxyethyl (meth)acrylate, propoxyethyl (meth)acrylate, butoxyethyl (meth)acrylate and ethoxypropyl (meth)acrylate; and alkoxy alkylene glycol (meth)acrylates (for example, alkoxy polyalkylene glycol (meth)acrylates) such as methoxy ethylene glycol (meth)acrylate, methoxy polyethylene glycol (meth)acrylate and methoxy polypropylene glycol (meth)acrylate.

[0058]

Alkoxysilyl group-containing monomers: for example, alkoxysilyl group-containing

(meth)acrylates such as 3-(meth)acryloxypropyl trimethoxysilane, 3-(meth)acryloxypropyl triethoxysilane, 3-(meth)acryloxypropylmethyl dimethoxysilane and 3-(meth)acryloxypropylmethyl diethoxysilane, alkoxysilyl group-containing vinyl compounds such as vinyltrimethoxysilane and vinyltriethoxysilane and the like.

5 [0059]

Vinyl esters: for example, vinyl acetate, vinyl propionate and the like.

[0060]

Vinyl ethers: for example, vinyl alkyl ethers such as methyl vinyl ether and ethyl vinyl ether.

10 [0061]

Aromatic vinyl compounds: for example, styrene, α -methyl styrene, vinyl toluene and the like.

[0062]

Olefins: for example, ethylene, butadiene, isoprene, isobutylene and the like.

15 [0063]

(Meth)acrylic acid esters having an alicyclic hydrocarbon group: for example, alicyclic hydrocarbon group-containing (meth)acrylates such as cyclopentyl (meth)acrylate, cyclohexyl (meth)acrylate, isobornyl (meth)acrylate, dicyclopentanyl (meth)acrylate and adamantyl (meth)acrylate.

20 [0064]

(Meth)acrylic acid esters having an aromatic hydrocarbon group: for example, aromatic hydrocarbon group-containing (meth)acrylates such as phenyl (meth)acrylate, phenoxyethyl (meth)acrylate and benzyl (meth)acrylate.

[0065]

25 Others including hetero ring-containing (meth)acrylates such as tetrahydrofurfuryl (meth)acrylate, halogen atom-containing (meth)acrylates such as vinyl chloride and fluorine atom-containing (meth)acrylates, silicon atom-containing (meth)acrylates such as silicone (meth)acrylate, (meth)acrylic acid esters obtained from a terpene compound derivative alcohol and the like.

30 [0066]

When such a copolymerizable monomer is used, the amount used is not particularly limited but is generally suitably 0.01 weight% or more of all the monomer components. To exhibit the effects of the use of the copolymerizable monomer more, the amount of the

copolymerizable monomer used may be 0.1 weight% or more of all the monomer components and may be 0.5 weight% or more. Moreover, to more easily keep the balance of the pressure-sensitive adhesive characteristics, the amount of the copolymerizable monomer used is generally suitably 50 weight% or less of all the monomer components and is preferably 40 weight% or less.

[0067]

In some aspects, the monomer components constituting the acrylic polymer can contain a monomer having a nitrogen atom. As a result, the cohesive force of the pressure-sensitive adhesive can be increased, and the peeling force over time can be preferably improved. A preferable example of the monomer having a nitrogen atom is a monomer having a nitrogen atom-containing ring. As the monomer having a nitrogen atom-containing ring, those described above as examples and the like can be used, and an example is a N-vinyl cyclic amide represented by the following general formula (1).

[0068]

[Chem. 1]



[0069]

In the general formula (1), R¹ is a divalent organic group and is specifically - (CH₂)_n-. n is an integer of 2 to 7 (preferably, 2, 3 or 4). In particular, N-vinyl-2-pyrrolidone can be preferably applied. Another preferable example of the monomer having a nitrogen atom is (meth)acrylamide.

[0070]

The amount of the monomer having a nitrogen atom (preferably the monomer having a nitrogen atom-containing ring) used is not particularly restricted and can be, for example, 1 weight% or more, 3 weight% or more, 5 weight% or more or 7 weight% or more of all the monomer components. In an aspect, the amount of the monomer having a nitrogen atom used may be 10 weight% or more of all the monomer components, may be 15 weight% or more and may be 20 weight% or more. Moreover, the amount of the monomer having a nitrogen atom used is, for example, suitably 40 weight% or less of all the monomer components, may be 35 weight% or less, may be 30 weight% or less and may be 25 weight% or less. In another aspect, the amount of the monomer having a nitrogen atom used may be, for example, 20 weight% or less of all the monomer components and may be 15 weight% or

less.

[0071]

In some aspects, the monomer components constituting the acrylic polymer can contain a hydroxyl group-containing monomer. When a hydroxyl group-containing monomer is used, the cohesive force or the degree of crosslinking (for example, crosslinking with an isocyanate crosslinking agent) of the pressure-sensitive adhesive can be preferably adjusted. When a hydroxyl group-containing monomer is used, the amount used is not particularly restricted, and the amount may be, for example, 0.01 weight% or more of all the monomer components, may be 0.1 weight% or more, may be 0.5 weight% or more and may be 1 weight% or more, 5 weight% or more or 10 weight% or more. Moreover, to inhibit the water absorption property of the pressure-sensitive adhesive layer, in some aspects, the amount of the hydroxyl group-containing monomer used is, for example, suitably 40 weight% or less of all the monomer components, may be 30 weight% or less, may be 25 weight% or less and may be 20 weight% or less. In another aspect, the amount of the hydroxyl group-containing monomer used may be, for example, 15 weight% or less of all the monomer components, may be 10 weight% or less and may be 5 weight% or less.

[0072]

In the pressure-sensitive adhesive composition in an embodiment of the invention, the monomer components of the acrylic polymer may contain but do not have to contain any of the alkoxyalkyl (meth)acrylates or the alkoxy polyalkylene glycol (meth)acrylates described above as examples. In an aspect of the technique according to the embodiment, the percentage of the alkoxyalkyl (meth)acrylate in the monomer components of the acrylic polymer is less than 20 weight%, and the percentage of the alkoxy polyalkylene glycol (meth)acrylate is less than 20 weight%. As a result, the pressure-sensitive adhesive layer can be easily formed into a sheet without a problem of gelation or the like. By applying the monomer composition, the solid content concentration of the monomer mixture can be maintained in a certain range, and a desired high molecular weight polymer (for example, a weight average molecular weight (Mw) exceeding 30×10^4 , typically Mw of 40×10^4 or more) can be preferably polymerized.

[0073]

The percentage of the alkoxyalkyl (meth)acrylate in the monomer components is preferably less than 10 weight%, more preferably less than 3 weight%, further preferably less than 1 weight%, and in a particularly preferable aspect, the monomer components do not

substantially contain the alkoxyalkyl (meth)acrylate (the amount is 0 to 0.3 weight%).

Similarly, the percentage of the alkoxy polyalkylene glycol (meth)acrylate in the monomer components is preferably less than 10 weight%, more preferably less than 3 weight%, further preferably less than 1 weight%, and in a particularly preferable aspect, the monomer components do not substantially contain the alkoxy polyalkylene glycol (meth)acrylate (the amount is 0 to 0.3 weight%).

[0074]

Moreover, to inhibit gelation, the total percentage of the alkoxyalkyl (meth)acrylate and the alkoxy polyalkylene glycol (meth)acrylate in the monomer components of the acrylic polymer according to a preferable aspect is restricted to less than 20 weight%. The total percentage of the alkoxyalkyl (meth)acrylate and the alkoxy polyalkylene glycol (meth)acrylate is more preferably less than 10 weight%, further preferably less than 3 weight%, particularly preferably less than 1 weight%, and in an aspect, the monomer components do not substantially contain the alkoxyalkyl (meth)acrylate or the alkoxy polyalkylene glycol (meth)acrylate (the amount is 0 to 0.3 weight%).

[0075]

Similarly, the monomer components of the acrylic polymer according to the embodiment can contain but do not have to contain an alkoxy group-containing monomer in a percentage of less than 20 weight%. The amount of the alkoxy group-containing monomer in the monomer components is preferably less than 10 weight%, more preferably less than 3 weight%, further preferably less than 1 weight%, and in a particularly preferable aspect, the monomer components do not substantially contain the alkoxy group-containing monomer (the amount is 0 to 0.3 weight%).

[0076]

In some aspects, the percentage of a carboxy group-containing monomer in the monomer components of the acrylic polymer may be, for example, 2 weight% or less, may be 1 weight% or less and may be 0.5 weight% or less (for example, less than 0.1 weight%). The carboxy group-containing monomer does not have to be substantially used as a monomer component of the acrylic polymer. Here, that the carboxy group-containing monomer is not substantially used means that the carboxy group-containing monomer is not used at least intentionally. An acrylic polymer having such a composition is likely to have high water resistance reliability and can have the property of preventing metal corrosion of an adherend containing a metal.

[0077]

In a preferable aspect, the percentage of the hydrophilic monomer in the monomer components of the acrylic polymer is restricted. Here, the “hydrophilic monomers” in the present specification mean carboxy group-containing monomers, acid anhydride group-containing monomers, hydroxyl group-containing monomers, monomers having a nitrogen atom (typically, amide group-containing monomers such as (meth)acryl amide and monomers having a nitrogen atom-containing ring such as N-vinyl-2-pyrrolidone) and alkoxy group-containing monomers (typically, alkoxyalkyl (meth)acrylates and alkoxy polyalkylene glycol (meth)acrylates).

[0078]

In this aspect, the percentage of the hydrophilic monomer in the monomer components of the acrylic polymer is preferably 32 weight% or less, may be, for example, 30 weight% or less and may be 28 weight% or less. Although the percentage is not particularly limited, the percentage of the hydrophilic monomer in the monomer components of the acrylic polymer may be 1 weight% or more, may be 10 weight% or more and may be 20 weight% or more.

[0079]

In some aspects, the monomer components constituting the acrylic polymer can contain an alicyclic hydrocarbon group-containing (meth)acrylate. As a result, the cohesive force of the pressure-sensitive adhesive can be improved, and the peeling force over time can be improved. As the alicyclic hydrocarbon group-containing (meth)acrylate, those described above as examples and the like can be used, and, for example, cyclohexyl acrylate and isobornyl acrylate can be preferably applied.

[0080]

When an alicyclic hydrocarbon group-containing (meth)acrylate is used, the amount used is not particularly restricted and can be, for example, 1 weight% or more of all the monomer components, 3 weight% or more or 5 weight% or more. In an aspect, the amount of the alicyclic hydrocarbon group-containing (meth)acrylate used may be 10 weight% or more of all the monomer components and may be 15 weight% or more. The upper limit of the amount of the alicyclic hydrocarbon group-containing (meth)acrylate used is suitably approximately 40 weight% or less, may be, for example, 30 weight% or less and may be 25 weight% or less (for example, 15 weight% or less, further 10 weight% or less).

[0081]

The composition of the monomer components constituting the acrylic polymer can be determined in such a manner that the glass transition temperature T_g determined by the Fox equation based on the composition of the monomer components becomes -75°C or higher and 10°C or lower. In some aspects, in view of the cohesiveness, the impact resistance and the like, the T_g is suitably 0°C or lower, preferably -10°C or lower and may be -20°C or lower or -30°C or lower. The T_g may be, for example, -60°C or higher, may be -50°C or higher and -45°C or higher or -40°C or higher.

[0082]

Here, as shown below, the Fox equation is a relational equation of the T_g of the copolymer and the glass transition temperatures T_{gi} of the homopolymers obtained by individually polymerizing the monomers constituting the copolymer.

$$1/T_g = \sum (W_i/T_{gi})$$

[0083]

In the Fox equation, T_g represents the glass transition temperature (unit: K) of the copolymer. W_i represents the weight fraction (the copolymerization percentage based on the weight) of the monomer i in the copolymer, and T_{gi} represents the glass transition temperature (unit: K) of the homopolymer of the monomer i .

[0084]

As the glass transition temperature of a homopolymer used for calculating the T_g , a value described in a known document is used. For example, with respect to the monomers listed below, the following values are used as the glass transition temperatures of the homopolymers of the monomers.

[0085]

2-Ethylhexyl acrylate	-70°C
n-Butyl acrylate	-55°C
Isostearyl acrylate	-18°C
Methyl methacrylate	105°C
Methyl acrylate	8°C
Cyclohexyl acrylate	15°C
N-Vinyl-2-pyrrolidone	54°C
2-Hydroxyethyl acrylate	-15°C
4-Hydroxybutyl acrylate	-40°C

Dicyclopentanyl methacrylate	175°C
Isobornyl acrylate	94°C
Acrylic acid	106°C
Methacrylic acid	228°C

5 [0086]

As the glass transition temperatures of the homopolymers of monomers other than those described above as examples, the values described in “Polymer Handbook” (Third Edition, John Wiley & Sons, Inc.,1989) are used. When two or more values are described in this document, the highest value is used.

10 [0087]

When the glass transition temperatures of the homopolymers of monomers are not described in the Polymer Handbook, either, values obtained by the following measurement method are used (see JP-A-2007-51271).

[0088]

15

Specifically, to a reactor equipped with a thermometer, a stirrer, a nitrogen introduction tube and a reflux cooling tube, 100 parts by weight of the monomer, 0.2 parts by weight of azobisisobutyronitrile and 200 parts by weight of ethyl acetate as a polymerization solvent are introduced and stirred for an hour while sending nitrogen gas. After removing oxygen in the polymerization system in this manner, the temperature is increased to 63°C, and the reaction is advanced for 10 hours. Next, after cooling to room temperature, a homopolymer solution having a solid content concentration of 33 weight% is obtained. Next, the homopolymer solution is flow-cast and applied onto a release liner and dried, and a test sample having a thickness of about 2 mm (a sheet of the homopolymer) is thus produced. The test sample is dried in a disc having a diameter of 7.9 mm, and the disc is inserted between parallel plates. The viscoelasticity is measured using a rheometer (ARES, manufactured by Rheometrics) while applying shear strain of frequency of 1 Hz in the shear mode of the temperature range of -70 to 150°C at a heating rate of 5°C/min, and the peak top temperature of the $\tan\delta$ is used as the Tg of the homopolymer.

25

[0089]

30

The SP value of the acrylic polymer according to the embodiment is not particularly limited but is preferably $23.0 \text{ (MJ/m}^3)^{1/2}$ or less. The SP value is more preferably $21.0 \text{ (MJ/m}^3)^{1/2}$ or less (for example, $20.0 \text{ (MJ/m}^3)^{1/2}$ or less). The lower limit of the SP value is not particularly limited and is, for example, approximately $10.0 \text{ (MJ/m}^3)^{1/2}$ or more, suitably

approximately $15.0 \text{ (MJ/m}^3)^{1/2}$ or more, preferably $18.0 \text{ (MJ/m}^3)^{1/2}$ or more.

[0090]

Here, the SP value of the acrylic polymer can be calculated by the Fedors calculation method [see "POLYMER ENG. & SCI.", Vol. 14, No. 2 (1974), pages 148 to 154], namely according to the following equation:

$$\text{SP value } \delta = (\Sigma \Delta e / \Sigma \Delta v)^{1/2}$$

(in the equation, Δe is the vaporization energy Δe of each atom or each atom group at 25°C , and Δv is the molar volume of each atom or each atom group at the same temperature). An acrylic polymer having the SP value can be obtained by appropriately determining the monomer composition based on the common technical knowledge of one skilled in the art.

[0091]

The pressure-sensitive adhesive composition contains the monomer components having the above composition in the form of a polymerized product, unpolymerized components (namely, in the form in which the polymerizable functional groups have not been reacted) or a mixture thereof. The pressure-sensitive adhesive composition can be in any of various forms of a water-dispersed pressure-sensitive adhesive composition in the form in which the pressure-sensitive adhesive (pressure-sensitive adhesive component) is dispersed in water, a solvent-type pressure-sensitive adhesive composition in the form containing the pressure-sensitive adhesive in an organic solvent, an active energy ray-curable pressure-sensitive adhesive composition prepared in such a manner that the pressure-sensitive adhesive is formed by curing with an active energy ray such as ultraviolet rays and radiation, a hotmelt-type pressure-sensitive adhesive composition which is applied in hot-melt state and which forms a pressure-sensitive adhesive when cooled to around room temperature and the like. The pressure-sensitive adhesive composition according to a preferable embodiment is a solvent-type pressure-sensitive adhesive composition or a solventless pressure-sensitive adhesive composition. Solventless pressure-sensitive adhesive compositions include an active energy ray-curable pressure-sensitive adhesive composition and a hotmelt-type pressure-sensitive adhesive composition.

[0092]

For the polymerization, a known or generally used thermal polymerization initiator or a photo-radical polymerization initiator can be used depending on the polymerization method, the polymerization form and the like. A kind of such polymerization initiators alone

or an appropriate combination of two or more kinds thereof can be used.

[0093]

The thermal polymerization initiator is not particularly limited, but for example, an azo-based polymerization initiator, a peroxide-based initiator, a redox-based initiator which is
5 a combination of a peroxide and a reducing agent, a substituted ethane-based initiator or the like can be used.

[0094]

More specific examples thereof include: azo-based initiators such as 2,2'-azobisisobutyronitrile (AIBN), 2,2'-azobis(2-methylpropionamidine) disulfate, 2,2'-azobis(2-amidinopropane) dihydrochloride, 2,2'-azobis[2-(5-methyl-2-imidazolin-2-yl)propane] dihydrochloride, 2,2'-azobis(N,N'-dimethyleneisobutylamidine) and 2,2'-azobis[N-(2-carboxyethyl)-2-methylpropionamidine] hydrate; persulfates such as potassium persulfate and ammonium persulfate; peroxide-based initiators such as benzoyl peroxide, t-butylhydroperoxide and hydrogen peroxide; substituted ethane-based initiators such as
15 phenyl-substituted ethane; redox-based initiators such as a combination of a persulfate and a sodium hydrogen sulfite and a combination of a peroxide and sodium ascorbate; and the like: although the initiator is not limited to the examples. The thermal polymerization can be preferably conducted, for example, at a temperature around 20 to 100°C (typically 40 to 80°C).

[0095]

The photo-radical polymerization initiator is not particularly limited, but examples thereof include 1-[4-(2-hydroxyethoxy)-phenyl]-2-hydroxy-2-methyl-1-propan-1-one, 1-hydroxy-cyclohexyl-phenyl-ketone, benzophenone, 2,2-dimethoxy-1,2-diphenylethan-1-one, 2,4,6-trimethylbenzoyl-diphenyl-phosphine oxide, 2,4,6-trimethylbenzoyl-phenylethoxy-phosphine oxide, 2-benzyl-2-dimethylamino-1-(4-morpholinophenyl)-butanone-1,2-hydroxy-2-methyl-1-phenyl-propan-1-one, 2-methyl-1-(4-methylthiophenyl)-2-morpholinopropan-1-one, benzoin methyl ether, benzoin ethyl ether, benzoin isobutyl ether, benzoin isopropyl ether, bis(2,4,6-trimethylbenzoyl)-phenylphosphine oxide, 2-hydroxy-2-methyl-[4-(1-methylvinyl)phenyl]propanol oligomer, 2-hydroxy-2-methyl-1-phenyl-1-propanone, isopropyl
30 thioxanthone, methyl o-benzoylbenzoate, [4-(methylphenylthio)phenyl]phenyl methane, 2,4-diethyl thioxanthone, 2-chloro thioxanthone, ethylanthraquinone, benzophenone ammonium salt, thioxanthone ammonium salt, bis(2,6-dimethylbenzoyl)-2,4,4-trimethyl-pentylphosphine oxide, 2,4,6-trimethyl benzophenone, 4-methyl benzophenone, 4,4'-bisdiethylamino

benzophenone, 1,4-dibenzoylbenzene, 10-butyl-2-chloroacrydone, 2,2'-bis(o-chlorophenyl)-4,5,4',5'-tetrakis(3,4,5-trimethoxyphenyl)-1,2'-biimidazole, 2,2'-bis(o-chlorophenyl)-4,5,4',5'-tetraphenyl-1,2'-biimidazole, 2-benzoylnaphthalene, 4-benzoylbiphenyl, 4-benzoyldiphenylether, acrylated benzophenone, bis(η 5-2,4-cyclopentadien-1-yl)-bis[2,6-difluoro-3-(1H-pyrrol-1-yl)-phenyl] titanium, o-methylbenzoylbenzoate, ethyl p-dimethylaminobenzoate, isoamyl ethyl p-dimethylaminobenzoate, active tertiary amine, arbazole-phenone-based photopolymerization initiators, acridine-based photopolymerization initiators, triazine-based photopolymerization initiators, benzoyl-based photopolymerization initiators and the like. A kind thereof or a combination of two or more kinds thereof is used.

[0096]

The amount of the thermal polymerization initiator or the photo-radical polymerization initiator used can be a general amount for use according to the polymerization method, the polymerization form and the like and is not particularly limited. For example, approximately 0.001 to 5 parts by mass (typically, approximately 0.01 to 2 parts by mass, for example, approximately 0.01 to 1 part by mass) of the polymerization initiator can be used based on 100 parts by mass of the monomer to be polymerized.

[0097]

For the polymerization, a conventionally known chain transfer agent (which can be also known as a molecular weight modifier or a polymerization degree modifier) can be used according to need. As the chain transfer agent, mercaptans such as n-dodecyl mercaptan, t-dodecyl mercaptan, thioglycolic acid and α -thioglycerol can be used. Alternatively, a chain transfer agent which does not contain any sulfur atom (a non-sulfur-based chain transfer agent) may also be used.

[0098]

Specific examples of the non-sulfur-based chain transfer agent include: anilines such as N,N-dimethylaniline and N,N-diethylaniline; terpenoids such as α -pinene and terpinolene; styrenes such as α -methyl styrene and α -methyl styrene dimer; compounds having a benzylidenyl group such as dibenzylideneacetone, cinnamyl alcohols and cinnamyl aldehydes; hydroquinones such as hydroquinone and naphthohydroquinone; quinones such as benzoquinone and naphthoquinone; olefins such as 2,3-dimethyl-2-butene and 1,5-cyclooctadiene; alcohols such as phenol, benzyl alcohol and allyl alcohol; benzyl hydrogens such as diphenyl benzene and triphenyl benzene; and the like.

[0099]

A kind of the chain transfer agents alone or a combination of two or more kinds thereof can be used. When a chain transfer agent is used, the amount used can be, for example, approximately around 0.01 to 1 part by mass based on 100 parts by mass of the monomer components. The technique according to the embodiment can be preferably
5 carried out also as an aspect in which the chain transfer agent is not used.

[0100]

The molecular weight of the acrylic polymer obtained by appropriately employing the polymerization methods is not particularly restricted and can be determined in an appropriate range according to the required properties. The weight average molecular
10 weight (Mw) of the acrylic polymer is generally approximately 10×10^4 or more (for example, 20×10^4 or more) and is suitably more than 30×10^4 to achieve both the cohesive force and the adhesion force with a good balance. The acrylic polymer according to an aspect preferably has Mw of 40×10^4 or more (typically approximately 50×10^4 or more, for example, approximately 55×10^4 or more) to obtain excellent adhesion reliability also in a high-
15 temperature environment. According to a preferable aspect of the technique according to the embodiment, the gelation can be inhibited due to the design of the monomer composition, and thus a polymer having a high molecular weight in the range can be obtained with high productivity by determining an appropriate solid content concentration. The upper limit of the Mw of the acrylic polymer can be generally approximately 500×10^4 or less (for example, approximately 150×10^4 or less). The Mw may be approximately 75×10^4 or less.
20

[0101]

Mw here means a value converted based on standard polystyrene obtained by gel permeation chromatography (GPC). As the GPC apparatus, for example, machine name “HLC-8320GPC” (column: TSKgelGMH-H(S), manufactured by Tosoh Corporation) may be
25 used. The same applies to the Examples described below. The Mw can be Mw of the acrylic polymer either in the pressure-sensitive adhesive composition or in the pressure-sensitive adhesive layer.

[0102]

The pressure-sensitive adhesive composition according to some embodiments can
30 be an active energy ray-curable pressure-sensitive adhesive composition. Examples of the active energy ray here include lights such as ultraviolet rays, visible light and infrared rays, radiation such as α -rays, β -rays, γ -rays, electron beam, neutron beam and X-rays and the like, and the active energy ray may be an energy ray having energy that can cause chemical

reactions such as polymerization reaction, crosslinking reaction and decomposition of an initiator.

[0103]

5 Regarding the pressure-sensitive adhesive composition in an embodiment of the invention, the timing of curing of the active energy ray-curable pressure-sensitive adhesive composition and the timing of the color change or the coloration can be preferably regulated to be different so that the pressure-sensitive adhesive composition can be changed in the color or colored at any timing. That is, the kinds of the components are preferably selected in such a manner that the timing of a chemical reaction such as the polymerization reaction and
10 the crosslinking reaction of the active energy ray-curable pressure-sensitive adhesive composition and the decomposition of the initiator does not overlap the timing of the reaction of the photoacid generator or the photobase generator described below and the color change or the coloration of the leuco dye. In other words, the composition is preferably designed in such a manner that the energy ray which causes a chemical reaction such as the
15 polymerization reaction, the crosslinking reaction and the decomposition of the initiator has a different wavelength for reaction than that of the energy ray to which the photoacid generator or the photobase generator described below reacts.

[0104]

20 A preferable example of the active energy ray-curable pressure-sensitive adhesive composition is a photocurable pressure-sensitive adhesive composition. A photocurable pressure-sensitive adhesive composition has an advantage because even a thick pressure-sensitive adhesive layer can be easily formed. In particular, an ultraviolet ray-curable pressure-sensitive adhesive composition is preferable.

[0105]

25 The photocurable pressure-sensitive adhesive composition typically contains at least a part of the monomer components of the composition (which may be one or some of the monomer kinds or may be a part of the amount) in the form of a polymer. The polymerization method for forming the polymer is not particularly limited, and a conventionally known polymerization method can be appropriately employed. Examples
30 which can be appropriately used include: thermal polymerization (typically conducted in the presence of a thermal polymerization initiator) such as solution polymerization, emulsion polymerization and bulk polymerization; photopolymerization conducted by irradiation with light such as ultraviolet rays (typically conducted in the presence of a photo-radical

polymerization initiator); radiation-induced polymerization conducted by irradiation with radiation such as β -rays and γ -rays; and the like. In particular, photopolymerization is preferable.

[0106]

5 The photocurable pressure-sensitive adhesive composition according to a preferable embodiment contains a partial polymer of the monomer components. Such a partial polymer is typically a mixture of a polymer derived from the monomer components and the unreacted monomers and is preferably in the form of syrup (a viscous liquid). The partial polymer having such a form is sometimes called “monomer syrup” or simply “syrup”. The
10 polymerization method for partially polymerizing the monomer components is not particularly restricted, and the polymerization methods described above can be appropriately selected and used. In view of the efficiency and the convenience, photopolymerization method can be preferably employed. According to photopolymerization, the polymerization conversion rate of the monomer components (monomer conversion) can be easily regulated
15 by the polymerization conditions such as the irradiance of the light (the amount of light).

[0107]

 The polymerization conversion rate of the monomer mixture in the partial polymer is not particularly limited. The polymerization conversion rate can be, for example, approximately 70 weight% or less and is preferably approximately 60 weight% or less. In
20 view of the easiness of preparation, the application and the like of the pressure-sensitive adhesive composition containing the partial polymer, the polymerization conversion rate is generally suitably approximately 50 weight% or less and is preferably approximately 40 weight% or less (for example, approximately 35 weight% or less). The lower limit of the polymerization conversion rate is not particularly restricted but is typically approximately 1
25 weight% or more and is generally suitably approximately 5 weight% or more.

[0108]

 The pressure-sensitive adhesive composition containing a partial polymer of the monomer components can be obtained, for example, by partially polymerizing a monomer mixture containing the whole amount of the monomer components used for preparing the
30 pressure-sensitive adhesive composition by an appropriate polymerization method (for example, photopolymerization method). Moreover, the pressure-sensitive adhesive composition containing a partial polymer of the monomer components may be a mixture of a partial polymer or a complete polymer of a monomer mixture containing a part of the

monomer components used for preparing the pressure-sensitive adhesive composition and the remaining monomer components or a partial polymer thereof. In the present specification, the “complete polymer” means that the polymerization conversion rate exceeds 95 weight%. [0109]

5 (Leuco Dye)

The pressure-sensitive adhesive composition in an embodiment of the invention contains a leuco dye. In the present specification, the leuco dye means an organic dye which changes in the color tone reversibly accompanying oxidation-reduction. The absorption wavelength thereof may change with the pH. More specifically, the leuco dye refers to a
10 reduced dye which develops a color by forming a dye through addition of an electron or removal of an electron and which has one, two or more hydrogen atoms. The leuco dye is a dye which is colorless or has a pale color in a neutral or alkaline medium and which is colored because the lactone ring is opened as shown in Fig. 1 when reacted with an acidic substance or an electron-withdrawing substance. By selecting a leuco dye which is substantially
15 colorless or has a pale color before the electron removal, the change in coloration can be remarkably observed.

[0110]

In the embodiment, the leuco dye is colored by the acid generated by irradiating the photoacid generator described below with an active energy ray.

20 [0111]

In the embodiment, the leuco dye can be colored when the lactone ring is opened and can then lose the color when the lactone ring is closed through reaction with a base. The base can be generated also by irradiating the photobase generator described below with an active energy ray.

25 [0112]

Examples of the leuco dye according to the embodiment include leuco compounds such as phthalide dyes (indolinophthalide-based, triphenylmethane phthalide-based or the like), fluoran dyes, triphenylmethane dyes, phenothiazine dyes, auramine dyes and spiropyran dyes.

30 [0113]

In view of the excellent color development property, the leuco dye is particularly preferably at least one leuco dye selected from the group consisting of a phthalide dye and a fluoran dye.

[0114]

Specific examples of the leuco dye include the following compounds.

[0115]

2'-Anilino-6'-(N,N-dipentan-1-ylamino)-3'-methyl-3H-spiro[isobenzofuran-1,9'-
xanthen]-3-one, 2-anilino-3-methyl-6-dibutylaminofluoran, 2-anilino-3-methyl-6-
dipentylaminofluoran, 2-anilino-3-methyl-6-[ethyl(4-methylphenyl)amino]fluoran, 3,3-bis(p-
dimethylaminophenyl)-phthalide, 3,3-bis(p-dimethylaminophenyl)-6-dimethylaminophthalide
(another name: crystal violet lactone), 3,3-bis(p-dimethylaminophenyl)-6-
diethylaminophthalide, 3,3-bis(p-dimethylaminophenyl)-6-chlorophthalide, 3,3-bis(p-
dibutylaminophenyl)phthalide, 3-cyclohexylamino-6-chlorofluoran, 3-dimethylamino-5,7-
dimethylfluoran, 3-(N-methyl-N-isobutyl)-6-methyl-7-anilinofluoran, 3-(N-ethyl-N-isoamyl)-
6-methyl-7-anilinofluoran, 3-diethylamino-7-chlorofluoran, 3-diethylamino-7-methylfluoran,
3-diethylamino-7,8-benzfluoran, 3-diethylamino-6-methyl-7-chlorofluoran, 3-(N-p-tolyl-N-
ethylamino)-6-methyl-7-anilinofluoran, 3-pyrrolidino-6-methyl-7-anilinofluoran, 2-{N-(3'-
trifluoromethylphenyl)amino}-6-diethylaminofluoran, 2-{3,6-bis(diethylamino)-9-(o-
chloroanilino)xanthyl benzoate lactam}3-diethylamino-6-methyl-7-(m-
trichloromethylanilino)fluoran, 3-diethylamino-7-(o-chloroanilino)fluoran, 3-dibutylamino-7-
(o-chloroanilino)fluoran, 3-(N-methyl-N-amylamino)-6-methyl-7-anilinofluoran, 3-(N-
methyl-N-cyclohexylamino)-6-methyl-7-anilinofluoran, 3-diethylamino-6-methyl-7-
anilinofluoran, 3-diethylamino-6-methyl-7-(2',4'-dimethylanilino)fluoran, 3-(N,N-
diethylamino)-5-methyl-7-(N,N-dibenzylamino)fluoran, benzoyl leuco methylene blue, 6'-
chloro-8'-methoxy-benzoindolino-spiropyran, 6'-bromo-3'-methoxy-benzoindolino-
spiropyran, 3-(2'-hydroxy-4'-dimethylaminophenyl)-3-(2'-methoxy-5'-
chlorophenyl)phthalide, 3-(2'-hydroxy-4'-dimethylaminophenyl)-3-(2'-methoxy-5'-
nitrophenyl)phthalide, 3-(2'-hydroxy-4'-diethylaminophenyl)-3-(2'-methoxy-5'-
methylphenyl)phthalide, 3-(2'-methoxy-4'-dimethylaminophenyl)-3-(2'-hydroxy-4'-chloro-
5'-methylphenyl)phthalide, 3-morpholino-7-(N-propyl-trifluoromethylanilino)fluoran, 3-
pyrrolidino-7-trifluoromethylanilinofluoran, 3-diethylamino-5-chloro-7-(N-benzyl-
trifluoromethylanilino)fluoran, 3-pyrrolidino-7-(di-p-chlorophenyl)methylaminofluoran, 3-
diethylamino-5-chloro-7-(α-phenylethylamino)fluoran, 3-(N-ethyl-p-toluidino)-7-(α-
phenylethylamino)fluoran, 3-diethylamino-7-(o-methoxycarbonylphenylamino)fluoran, 3-
diethylamino-5-methyl-7-(α-phenylethylamino)fluoran, 3-diethylamino-7-piperidinofluoran,
2-chloro-3-(N-methyltoluidino)-7-(p-n-butylanilino)fluoran, 3-(N-methyl-N-isopropylamino)-

6-methyl-7-anilino-fluoran, 3-dibutylamino-6-methyl-7-anilino-fluoran, 3,6-bis(dimethylamino)fluorenespiro(9,3')-6'-dimethylaminophthalide, 3-(N-benzyl-N-cyclohexylamino)-5,6-benzo-7- α -naphthylamino-4'-bromofluoran, 3-diethylamino-6-chloro-7-anilino-fluoran, 3-{N-ethyl-N-(2-ethoxypropyl)amino}-6-methyl-7-anilino-fluoran, 3-{N-ethyl-N-tetrahydrofurfurylamino}-6-methyl-7-anilino-fluoran, 3-diethylamino-6-methyl-7-mesithidino-4',5'-benzofluoran, 3-(p-dimethylaminophenyl)-3-{1,1-bis(p-dimethylaminophenyl)ethylen-2-yl}phthalide, 3-(p-dimethylaminophenyl)-3-{1,1-bis(p-dimethylaminophenyl)ethylen-2-yl}-6-dimethylaminophthalide, 3-(p-dimethylaminophenyl)-3-(1-p-dimethylaminophenyl-1-phenylethylen-2-yl)phthalide, 3-(p-dimethylaminophenyl)-3-(1-p-dimethylaminophenyl-1-p-chlorophenylethylen-2-yl)-6-dimethylaminophthalide, 3-(4'-dimethylamino-2'-methoxy)-3-(1''-p-dimethylaminophenyl-1''-p-chlorophenyl-1'',3''-butadien-4''-yl)benzophthalide, 3-(4'-dimethylamino-2'-benzyloxy)-3-(1''-p-dimethylaminophenyl-1''-phenyl-1'',3''-butadien-4''-yl)benzophthalide, 3-dimethylamino-6-dimethylamino-fluorene-9-spiro-3'(6'-dimethylamino)phthalide, 6-(diethylamino)-2-[(3-trifluoromethyl)anilino]xanthene-9-spiro-3'-phthalide, 3,3-bis{2-(p-dimethylaminophenyl)-2-(p-methoxyphenyl)ethenyl}-4,5,6,7-tetrachlorophthalide, 3-bis{1,1-bis(4-pyrrolidinophenyl)ethylen-2-yl}-5,6-dichloro-4,7-dibromophthalide, bis(p-dimethylaminostyryl)-1-naphthalene sulfonyl methane and bis(p-dimethylaminostyryl)-1-p-tolylsulfonyl methane.

[0116]

As the leuco dye according to the embodiment, one kind may be used alone, or two or more kinds may be mixed and used.

[0117]

In the embodiments of the invention, the amount of the leuco dye is preferably 0.01 to 30 parts by mass per 100 parts by mass of the base polymer, more preferably 0.1 to 30 parts by mass, further preferably 0.1 to 20 parts by mass, further preferably 1 to 10 parts by mass. In the range, the color change or the coloration by the leuco dye can be remarkably observed.

[0118]

(Photoacid Generator)

The pressure-sensitive adhesive composition in an embodiment of the invention contains a photoacid generator. In the present specification, a photoacid generator is a compound which can generate an acid (cation) by irradiation with an active energy ray which is not limited to light such as ultraviolet rays, visible light and infrared rays and which can

also be radiation such as α -rays, β -rays, γ -rays, electron beam, neutron beam and X-rays or the like. Because the photoacid generator generates an acid only after irradiation with the active energy ray, a pressure-sensitive adhesive layer or a pressure-sensitive adhesive sheet obtained using the pressure-sensitive adhesive composition can be changed in the color or colored at any timing when the photoacid generator is used together with the leuco dye.
[0119]

The photoacid generator is not particularly restricted as long as the photoacid generator is a compound which can generate an acid (cation) by irradiation with an active energy ray, and examples thereof include a sulfonium salt compound, an iodonium salt compound, an aromatic N-oxyimidosulfonate, a sulfonic acid ester compound, a halomethyl-substituted-S-triazine derivative and the like.
[0120]

In view of the excellent compatibility with the other components of the pressure-sensitive adhesive composition according to the invention, the photoacid generator is particularly preferably at least one compound selected from the group consisting of a sulfonium salt compound, an iodonium salt compound and an aromatic N-oxyimidosulfonate.
[0121]

Specific examples of the sulfonium salt compound include salts of a cation such as dimethyl phenacyl sulfonium, dimethyl benzyl sulfonium, dimethyl-4-hydroxyphenyl sulfonium, dimethyl-4-hydroxynaphthyl sulfonium, dimethyl-4,7-dihydroxynaphthyl sulfonium, dimethyl-4,8-dihydroxynaphthyl sulfonium, triphenyl sulfonium, p-tolyldiphenyl sulfonium, p-tert-butylphenyldiphenyl sulfonium and diphenyl-4-phenylthiophenyl sulfonium and an anion such as chloride, bromide, p-toluenesulfonate, trifluoromethanesulfonate, tetrafluoroborate, tetrakis pentafluorophenyl borate, tetrakis pentafluorophenyl gallate, hexafluorophosphate, hexafluoroarsenate, hexafluoroantimonate and nonafluorobutanesulfonate.
[0122]

Examples of the iodonium salt compound include salts of a cation such as diphenyl iodonium, bis(p-chlorophenyl)iodonium, ditolyl iodonium, bis(p-tert-butylphenyl)iodonium, p-isopropylphenyl-p-methylphenyl iodonium, bis(m-nitrophenyl)iodonium, p-tert-butylphenylphenyl iodonium, p-methoxyphenylphenyl iodonium, bis(p-methoxyphenyl)iodonium, p-octyloxyphenylphenyl iodonium and p-phenoxyphenylphenyl iodonium and an anion such as chloride, bromide, p-toluenesulfonate,

trifluoromethanesulfonate, tetrafluoroborate, tetrakis pentafluorophenyl borate, tetrakis pentafluorophenyl gallate, hexafluorophosphate, hexafluoroarsenate, hexafluoroantimonate and nonafluorobutanesulfonate.

[0123]

5 Examples of the aromatic N-oxyimidosulfonate include N-(trifluoromethylsulfonyloxy)succinimide, N-(trifluoromethylsulfonyloxy)phthalimide, N-(trifluoromethylsulfonyloxy)diphenylmaleimide, N-(trifluoromethylsulfonyloxy)bicyclohept-5-ene-2,3-dicarboxyimide, N-(trifluoromethylsulfonyloxy)naphthylimide and the like.

[0124]

10 Examples of the sulfonic acid ester compound include benzointosylate, α -methylolbenzointosylate, o-nitrobenzyl p-toluenesulfonate, p-nitrobenzyl-9,10-diethoxyanthracene-2-sulfonate and the like. Specific examples of the halomethyl-substituted-S-triazine derivative include 2,4,6-tris(trichloromethyl)-S-triazine, 2-methyl-4,6-bis(trichloromethyl)-S-triazine, 2-phenyl-4,6-bis(trichloromethyl)-S-triazine, 2-methyl-4,6-bis(tribromomethyl)-S-triazine and the like.

[0125]

 In the embodiments of the invention, the amount of the photoacid generator is preferably 0.001 to 30 parts by mass per 100 parts by mass of the base polymer, more preferably 0.01 to 25 parts by mass, further preferably 0.1 to 30 parts by mass, further
20 preferably 0.1 to 20 parts by mass. In the range, the acid can be generated efficiently by the irradiation with the active energy ray, and the color change or the coloration can be remarkably observed.

[0126]

(Photobase Generator)

25 The pressure-sensitive adhesive composition in an embodiment of the invention can contain a photobase generator. A photobase generator is a compound which can generate a base (anion) by irradiation with an active energy ray which is not limited to light such as ultraviolet rays, visible light and infrared rays and which can also be radiation such as α -rays, β -rays, γ -rays, electron beam, neutron beam and X-rays or the like. Because the photobase
30 generator generates a base only after irradiation with the active energy ray, the leuco dye can be reduced at any timing after the coloration of the leuco dye, and the coloration can be removed.

[0127]

When the pressure-sensitive adhesive composition in an embodiment of the invention contains the photobase generator, the combination of the photoacid generator and the photobase generator is preferably determined in such a manner that the photobase generator does not generate the base at the same timing as the photoacid generator generates the acid by irradiation with the active energy ray. That is, the photobase generator is preferably designed in such a manner that the base is generated by an active energy ray which is of different kind from the active energy ray required for the generation of the acid from the photoacid generator.

[0128]

The photobase generator is not particularly restricted as long as the photobase generator is a compound which can generate a base (anion) by irradiation with an active energy ray, and examples thereof include transition metal complexes, compounds having a benzyl carbamate structure, compounds having an ortho-substituted nitrobenzene structure, oximes, imidazole derivatives, benzoin-based compounds, compounds having an N-formylated aromatic amino group, compounds having an N-acylated aromatic amino group, compounds having an alkooxybenzyl carbamate group, compounds having a 1,4-dihydropyridine skeleton, oxime esters, quaternary ammonium salts and the like.

[0129]

The amount of the photobase generator according to the embodiment is preferably 0.001 to 30 parts by mass per 100 parts by mass of the base polymer, more preferably 0.01 to 25 parts by mass, further preferably 0.1 to 20 parts by mass. In the range, the base can be generated efficiently by irradiation with the active energy ray, and the color of the colored pressure-sensitive adhesive sheet can be removed.

[0130]

(Release Force Enhancer)

The pressure-sensitive adhesive composition in an embodiment of the invention can contain a release force enhancer. As the release force enhancer, a material which can exhibit the function of enhancing the release force of a pressure-sensitive adhesive sheet from an adherend after adhering the surface (pressure-sensitive adhesive surface) of a pressure-sensitive adhesive layer formed from the pressure-sensitive adhesive composition to the adherend can be appropriately selected and used. As the release force enhancer, for example, a known silane coupling agent can be used. The release force enhancer is preferably contained in the pressure-sensitive adhesive composition (and therefore in the

pressure-sensitive adhesive layer) in a free state. The release force enhancer is typically preferably not chemically bonded to the other components which can be contained in the pressure-sensitive adhesive composition (and therefore in the pressure-sensitive adhesive layer). The release force enhancer contained in the pressure-sensitive adhesive composition
5 in such a state can effectively contribute to enhancement of the release force.

[0131]

The silane coupling agent is typically a compound which contains a functional group X and a functional group Y in one molecule and in which the functional group X is an alkoxysilyl group. The alkoxysilyl group is a functional group which has at least one alkoxy
10 group on a silicon atom. When the silane coupling agent is supplied to the surface of the pressure-sensitive adhesive layer after adhesion to the adherend, the alkoxy group is hydrolyzed, and a thus generated silanol group and the hydroxyl group on the surface of the adherend are reacted. As a result, the release force of the pressure-sensitive adhesive sheet from the adherend can be enhanced. Through hydrolysis, the alkoxysilyl group generates a
15 silanol group, which reacts with a hydroxyl group on the surface of the adherend. Therefore, the alkoxysilyl group is a precursor of the group which reacts with the hydroxyl group.

[0132]

The alkoxy group constituting the alkoxysilyl group is typically a methoxy group or an ethoxy group. In general, a methoxy group, which has higher hydrolytic property, is
20 preferable. The alkoxysilyl group may be a trialkoxysilyl group and may be a dialkoxysilyl group. To improve the effect of enhancing the release force, in some aspects, a silane coupling agent having a trialkoxysilyl group can be preferably used.

[0133]

The functional group Y can be, for example, an epoxy group, an amino group, an
25 isocyanate group (which may form an isocyanurate), an acetoacetyl group, a (meth)acryloyl group, a mercapto group, a vinyl group, a halogenated alkyl group or the like. Examples of the silane coupling agent having such a functional group Y include: epoxy group-containing silane coupling agents such as 3-glycidoxypropyltrimethoxysilane, 3-glycidoxypropyltriethoxysilane, 3-glycidoxypropylmethyldimethoxysilane and 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane; amino group-containing silane coupling agents such
30 as 3-aminopropyltrimethoxysilane, N-(2-aminoethyl) 3-aminopropyltrimethoxysilane and N-(2-aminoethyl) 3-aminopropylmethyldimethoxysilane; isocyanate group-containing silane coupling agents such as 3-isocyanatopropyltriethoxysilane and

tris(trimethoxysilylpropyl)isocyanurate; acetoacetyl group-containing silane coupling agents such as acetoacetyl group-containing trimethoxysilane; (meth)acryloyl group-containing silane coupling agents such as 3-methacryloxypropyltrimethoxysilane, 3-methacryloxypropyltriethoxysilane and 3-acryloxypropyltrimethoxysilane; vinyl group-containing silane coupling agents such as vinyltrimethoxysilane and vinyltriethoxysilane; mercapto group-containing silane coupling agents such as 3-methacryloxypropylmethyldimethoxysilane and 3-methacryloxypropyltrimethoxysilane; halogenated alkyl group-containing silane coupling agents such as 3-chloropropyltrimethoxysilane; and the like. Of the examples, epoxy group-containing silane coupling agents such as glycidoxypropyltrialkoxysilanes (for example, 3-glycidoxypropyltrimethoxysilane or 3-glycidoxypropyltriethoxysilane) are preferable.

[0134]

As the silane coupling agent, a silane coupling agent having a functional group Y which reacts with a functional group y contained in the pressure-sensitive adhesive layer can be used. In view of the reactivity at normal temperature, a combination of a carboxy group as the functional group y and a silane coupling agent having an epoxy group as the functional group Y is used. Examples of other combinations include a combination of an amino group and an epoxy group, a combination of a hydroxyl group and an epoxy group, a combination of a carboxy group and an amino group, a combination of an isocyanate group and an amino group, a combination of a sulfo group and an amino group and the like. In some aspects, to maintain the release force enhancer in a free state in the pressure-sensitive adhesive composition and to thus easily transfer the release force enhancer to the surface, the pressure-sensitive adhesive composition does not have to have a functional group y (for example, a carboxy group) which reacts with the functional group Y (for example, an epoxy group) of the silane coupling agent.

[0135]

The molecular weight (chemical formula weight) of the silane coupling agent is not particularly limited and can be, for example, around 120 to 1000. In general, in view of the easiness of controlling the reworkable period and the transfer to the pressure-sensitive adhesive surface, a silane coupling agent having a molecular weight of 180 or more, 200 or more or 220 or more is generally preferable. For the same reasons, a silane coupling agent having a molecular weight of 800 or less, 600 or less, 400 or less or 300 or less is preferable. In some aspects, a silane coupling agent having a molecular weight of 200 or more and 300 or

less can be preferably used. As the value of the molecular weight of the silane coupling agent, a value calculated based on the structural formula of the silane coupling agent is used. Alternatively, the official value of the manufacturer may also be used.

[0136]

5 The amount of the release force enhancer (for example, the silane coupling agent) contained in the pressure-sensitive adhesive composition in an embodiment of the invention can be determined in such a manner that the desired effects of use can be obtained, and the amount is not particularly limited. The amount of the release force enhancer can be, for example, 0.005 parts by mass or more per 100 parts by mass of the base polymer contained in
10 the pressure-sensitive adhesive composition. The release force enhancer content per 100 parts by mass of the base polymer is generally suitably 0.05 parts by mass or more and may be 0.10 parts by mass or more, 0.20 parts by mass or more or 0.30 parts by mass or more. When the release force enhancer content is increased, an effect of enhancing the release force can be exhibited.

15 [0137]

 Regarding the release force enhancer, depending on the use type, when the period required until the release force is enhanced with time at room temperature is too short, problems may arise because the reworkable period becomes too short, resulting in complicated step management. From the point, in some aspects, the release force enhancer
20 content of the pressure-sensitive adhesive composition per 100 parts by mass of the base polymer may be, for example, 5 parts by mass or less, may be 3 parts by mass or less, may be 1 part by mass or less and may be 0.7 parts by mass or less (for example, 0.5 parts by mass or less).

[0138]

25 (Crosslinking Agent)

 The pressure-sensitive adhesive composition in an embodiment of the invention can contain a crosslinking agent according to need mainly for the purpose of crosslinking in the pressure-sensitive adhesive layer or crosslinking between the pressure-sensitive adhesive layer and the adjacent surface. The kind of the crosslinking agent is not particularly
30 restricted, and a kind can be selected from the conventionally known crosslinking agents, for example, depending on the composition of the pressure-sensitive adhesive composition, in such a manner that the crosslinking agent exhibits appropriate crosslinking function in the pressure-sensitive adhesive layer.

[0139]

Examples of the crosslinking agent which can be used include an isocyanate-based crosslinking agent, an epoxy-based crosslinking agent, an oxazoline-based crosslinking agent, an aziridine-based crosslinking agent, a carbodiimide-based crosslinking agent, a melamine-based crosslinking agent, a urea-based crosslinking agent, a metal alkoxide-based crosslinking agent, a metal chelate-based crosslinking agent, a metal salt-based crosslinking agent, a hydrazine-based crosslinking agent, an amine-based crosslinking agent and the like. A kind thereof alone or a combination of two or more kinds thereof can be used.

[0140]

As the isocyanate-based crosslinking agent, a polyfunctional isocyanate compound having two or more functional groups can be used. Examples thereof include: aromatic isocyanates such as tolylene diisocyanate, xylene diisocyanate, polymethylene polyphenyl diisocyanate, tris(p-isocyanatophenyl)thiophosphate and diphenylmethane diisocyanate; alicyclic isocyanates such as isophorone diisocyanate; aliphatic isocyanates such as hexamethylene diisocyanate; and the like. Examples of commercial products include isocyanate adducts such as a trimethylolpropane/tolylene diisocyanate trimer adduct (manufactured by Tosoh Corporation, product name "Coronate L"), a trimethylolpropane/hexamethylene diisocyanate trimer adduct (manufactured by Tosoh Corporation, product name "Coronate HL") and an isocyanurate of hexamethylene diisocyanate (manufactured by Tosoh Corporation, product name "Coronate HX") and the like.

[0141]

As the epoxy-based crosslinking agent, a crosslinking agent having two or more epoxy groups in one molecule can be used without particular restriction. An epoxy-based crosslinking agent having three to five epoxy groups in one molecule is preferable. Specific examples of the epoxy-based crosslinking agent include N,N,N',N'-tetraglycidyl-m-xylenediamine, 1,3-bis(N,N-diglycidylaminomethyl)cyclohexane, 1,6-hexanediol diglycidyl ether, polyethyleneglycol diglycidyl ether, polyglycerol polyglycidyl ether and the like.

Commercial products of the epoxy-based crosslinking agent include product names "TETRAD-X" and "TETRAD-C" manufactured by Mitsubishi Gas Chemical Company, Inc., product name "Epicon CR-5L" manufactured by DIC Corporation, product name "Denacol EX-512" manufactured by Nagase ChemteX Corporation, product name "TEPIC-G" manufactured by Nissan Chemical Industries, Ltd. and the like.

[0142]

As the oxazoline-based crosslinking agent, a crosslinking agent having one or more oxazoline groups in one molecule can be used without particular restriction.

[0143]

5 Examples of the aziridine-based crosslinking agent include trimethylolpropane tris[3-(1-aziridiny)propionate], trimethylolpropane tris[3-(1-(2-methyl)aziridiny)propionate]] and the like.

[0144]

10 As the carbodiimide-based crosslinking agent, a low-molecular-weight compound or a high-molecular-weight compound having two or more carbodiimide groups can be used.

[0145]

 In some aspects, a peroxide may be used as the crosslinking agent. The peroxide is di(2-ethylhexyl)peroxydicarbonate, di(4-t-butylcyclohexyl)peroxydicarbonate, di-sec-butylperoxydicarbonate, t-butylperoxyneodecanoate, t-hexylperoxypivalate, t-butyl
15 peroxypivalate, dilauroyl peroxide, di-n-octanoyl peroxide, 1,1,3,3-tetramethylbutyl peroxyisobutyrate, dibenzoyl peroxide or the like. Of the peroxides, di(4-t-butylcyclohexyl)peroxydicarbonate, dilauroyl peroxide, dibenzoyl peroxide and the like are peroxides which have particularly excellent crosslinking reaction efficiency.

[0146]

20 When a peroxide is used as the polymerization initiator, the remaining peroxide which has not been used for the polymerization reaction can be used in the crosslinking reaction. In this case, the amount of the remaining peroxide is determined, and when the percentage of the peroxide is lower than the predetermined amount, the peroxide is added to achieve the predetermined amount according to need. The amount of the peroxide can be
25 determined by the method described in Japanese Patent No. 4971517.

[0147]

 The crosslinking agent content (the total amount when two or more kinds of crosslinking agent are contained) is not particularly limited. To achieve a pressure-sensitive adhesive which exhibits pressure-sensitive adhesive characteristics such as adhesion force and
30 cohesive force with a good balance, the crosslinking agent content is generally suitably approximately 5 parts by mass or less based on 100 parts by mass of the base polymer contained in the pressure-sensitive adhesive composition, preferably approximately 0.001 to 5 parts by mass, more preferably approximately 0.001 to 4 parts by mass, further preferably

approximately 0.001 to 3 parts by mass.

[0148]

Alternatively, a pressure-sensitive adhesive composition which does not contain the crosslinking agent described above may also be used. When a photocurable pressure-sensitive adhesive composition is used as the pressure-sensitive adhesive composition in an embodiment of the invention, the pressure-sensitive adhesive composition can be a composition which does not substantially contain a crosslinking agent such as an isocyanate-based crosslinking agent. Here, that the pressure-sensitive adhesive composition does not substantially contain a crosslinking agent (typically, an isocyanate-based crosslinking agent) means that the amount of the crosslinking agent based on 100 parts by mass of the base polymer is less than 0.05 parts by mass (for example, less than 0.01 parts by mass).

[0149]

To more effectively advance the crosslinking reaction, a crosslinking catalyst may be used. Examples of the crosslinking catalyst include metal-based crosslinking catalysts such as tetra-n-butyl titanate, tetraisopropyl titanate, Nacem Iron (II), butyltin oxide and dioctyltin dilaurate and the like. In particular, a tin-based crosslinking catalyst such as dioctyltin dilaurate is preferable.

[0150]

The amount of the crosslinking catalyst used is not particularly restricted. The amount of the crosslinking catalyst used based on 100 parts by mass of the base polymer in the pressure-sensitive adhesive composition may be, for example, approximately 0.0001 parts by mass or more and 1 part by mass or less, may be 0.001 parts by mass or more and 0.1 parts by mass or less and may be 0.005 parts by mass or more and 0.5 parts by mass or less.

[0151]

For the pressure-sensitive adhesive composition (and therefore for the pressure-sensitive adhesive layer), a polyfunctional monomer can be used according to need. The polyfunctional monomer can contribute for the purpose of adjusting the cohesive force or for another purpose when used instead of the crosslinking agent described above or in combination with the crosslinking agent. For example, a polyfunctional monomer can be preferably used in a pressure-sensitive adhesive layer formed from a photocurable pressure-sensitive adhesive composition.

[0152]

Examples of the polyfunctional monomer include ethylene glycol di(meth)acrylate,

propylene glycol di(meth)acrylate, polyethylene glycol di(meth)acrylate, polypropylene glycol di(meth)acrylate, neopentyl glycol di(meth)acrylate, pentaerythritol di(meth)acrylate, pentaerythritol tri(meth)acrylate, dipentaerythritol hexa(meth)acrylate, ethylene glycol di(meth)acrylate, 1,6-hexanediol di(meth)acrylate, 1,12-dodecanediol di(meth)acrylate, trimethylolpropane tri(meth)acrylate, tetramethylolmethane tri(meth)acrylate, allyl (meth)acrylate, vinyl (meth)acrylate, divinylbenzene, epoxy acrylate, polyester acrylate, urethane acrylate, butyldiol (meth)acrylate, hexyldiol di(meth)acrylate and the like.

[0153]

Of the examples, trimethylolpropane tri(meth)acrylate, 1,6-hexanediol di(meth)acrylate and dipentaerythritol hexa(meth)acrylate can be preferably used. A kind of the polyfunctional monomers alone or a combination of two or more kinds thereof can be used.

[0154]

The amount of the polyfunctional monomer used differs with the molecular weight, the number of functional groups and the like but is generally suitably in the range of around 0.01 parts by mass to 3.0 parts by mass based on 100 parts by mass of the base polymer. In some aspects, the amount of the polyfunctional monomer used based on 100 parts by mass of the base polymer may be, for example, 0.02 parts by mass or more, may be 0.1 parts by mass or more and may be 0.5 parts by mass or more, 1.0 part by mass or more or 2.0 parts by mass or more. When the amount of the polyfunctional monomer used increases, higher cohesive force tends to be obtained.

[0155]

On the other hand, to avoid a decrease in the adhesiveness between the pressure-sensitive adhesive layer and the adjacent layer due to excessive improvement of the cohesive force, the amount of the polyfunctional monomer used based on 100 parts by mass of the base polymer may be, for example, 10 parts by mass or less, may be 5.0 parts by mass or less and may be 3.0 parts by mass or less.

[0156]

(Acrylic Oligomer)

The pressure-sensitive adhesive composition in an embodiment of the invention (and therefore the pressure-sensitive adhesive layer) can contain an acrylic oligomer to improve the cohesive force or to improve the adhesiveness to the surface adjacent to the pressure-sensitive adhesive layer (which can be, for example, the surface of the base material

or the like).

[0157]

As the acrylic oligomer, a polymer having a higher Tg than the Tg of the acrylic polymer is preferably used.

5 [0158]

The Tg of the acrylic oligomer is not particularly limited and can be, for example, about 20°C or higher and 300°C or lower. The Tg may be, for example, about 30°C or higher, may be about 40°C or higher, may be about 60°C or higher and may be about 80°C or higher or about 100°C or higher. As the Tg of the acrylic oligomer becomes higher, the effect of improving the cohesive force generally tends to become higher.

10

[0159]

In view of the anchoring property to the base material, the impact-absorbing property or the like, the Tg of the acrylic oligomer may be, for example, about 250°C or lower and may be about 200°C or lower, about 180°C or lower or about 150°C or lower. Similar to the Tg of the acrylic polymer corresponding to the composition of the monomer components, the Tg of the acrylic oligomer is a value calculated based on the Fox equation.

15

[0160]

The Mw of the acrylic oligomer can be typically about 1000 or more and less than about 30000, preferably about 1500 or more and less than about 10000, further preferably about 2000 or more and less than about 5000. When the Mw is in the range, the effect of improving the cohesiveness or the adhesiveness to the adjacent surface is more preferably exhibited.

20

[0161]

The Mw of the acrylic oligomer can be measured by gel permeation chromatography (GPC) and determined as a value converted based on standard polystyrene. Specifically, the Mw is measured using HPLC8020 manufactured by Tosoh Corporation using two TSKgelGMH-H(20) columns using a tetrahydrofuran solvent under the condition of a flow rate of about 0.5 mL/min.

25

[0162]

The monomer components constituting the acrylic oligomer may be (meth)acrylate monomers including: the C₁₋₂₀ alkyl (meth)acrylic acid esters described above; the alicyclic hydrocarbon group-containing (meth)acrylates described above; the aromatic hydrocarbon group-containing (meth)acrylates described above; (meth)acrylates obtained from a terpene

30

compound derivative alcohol; and the like. A kind thereof alone or a combination of two or more kinds thereof can be used.

[0163]

To improve the adhesiveness, the acrylic oligomer preferably contains, as a monomer unit, an acrylic monomer having a relatively bulky structure which is typically as follows: an alkyl (meth)acrylate in which the alkyl group has a branched structure, such as isobutyl (meth)acrylate and t-butyl (meth)acrylate; an alicyclic hydrocarbon group-containing (meth)acrylate or an aromatic hydrocarbon group-containing (meth)acrylate; or the like.

[0164]

When ultraviolet rays are used for the synthesis of the acrylic oligomer or the production of the pressure-sensitive adhesive layer, because the polymerization is not easily inhibited, a monomer having a saturated hydrocarbon group at the ester terminal is preferable, and for example, an alkyl (meth)acrylate in which the alkyl group has a branched structure and a saturated alicyclic hydrocarbon group-containing (meth)acrylate can be preferably used.

[0165]

The percentage of the (meth)acrylate monomer in all the monomer components constituting the acrylic oligomer is typically more than 50 weight%, preferably 60 weight% or more, more preferably 70 weight% or more (for example, 80 weight% or more, further 90 weight% or more).

[0166]

In a preferable aspect, the acrylic oligomer has a monomer composition substantially consisting of one, two or more kinds of (meth)acrylate monomer. When the monomer components contain an alicyclic hydrocarbon group-containing (meth)acrylate and a C₁₋₂₀ alkyl (meth)acrylic acid ester, the weight ratio thereof is not particularly limited and can be, for example, in the range of 10/90 to 90/10, in the range of 20/80 to 80/20, in the range of 70/30 to 30/70 or the like.

[0167]

As the monomer components constituting the acrylic oligomer, a functional group-containing monomer can be used according to need in addition to the (meth)acrylate monomer described above. Examples of the functional group-containing monomer include: monomers having a nitrogen atom-containing hetero ring such as N-vinyl-2-pyrrolidone and N-acryloylmorpholine; amino group-containing monomers such as N,N-dimethylaminoethyl (meth)acrylate; amide group-containing monomers such as N,N-diethyl (meth)acrylamide;

carboxy group-containing monomers such as AA and MAA; and hydroxyl group-containing monomers such as 2-hydroxyethyl (meth)acrylate. A kind of the functional group-containing monomers alone or a combination of two or more kinds thereof can be used.

[0168]

5 When the functional group-containing monomer is used, the percentage of the functional group-containing monomer in all the monomer components constituting the acrylic oligomer can be, for example, 1 weight% or more, 2 weight% or more or 3 weight% or more and can be, for example, 15 weight% or less, 10 weight% or less or 7 weight% or less.

[0169]

10 Preferable examples of the acrylic oligomer include homopolymers such as dicyclopentanyl methacrylate (DCPMA), cyclohexyl methacrylate (CHMA), isobornyl methacrylate (IBXMA), isobornyl acrylate (IBXA), dicyclopentanyl acrylate (DCPA), 1-adamantyl methacrylate (ADMA) and 1-adamantyl acrylate (ADA) as well as a copolymer of DCPMA and MMA, a copolymer of DCPMA and IBXMA, a copolymer of ADA and methyl
15 methacrylate (MMA), a copolymer of CHMA and isobutyl methacrylate (IBMA), a copolymer of CHMA and IBXMA, a copolymer of CHMA and acryloylmorpholine (ACMO), a copolymer of CHMA and diethyl acrylamide (DEAA), a copolymer of CHMA and AA and the like.

[0170]

20 The acrylic oligomer can be formed by polymerizing the monomer components. The polymerization method and the polymerization form are not particularly limited, and a conventionally known polymerization method (for example, solution polymerization, emulsion polymerization, bulk polymerization, photopolymerization, radiation-induced polymerization or the like) can be employed in an appropriate form. The kind of the
25 polymerization initiator (for example, an azo-based polymerization initiator) which can be used according to need is generally as described in the examples for the synthesis of the acrylic polymer, and the amount of the polymerization initiator and the amount of a chain transfer agent (for example, a mercaptan) which is optionally used are appropriately determined based on the common technical knowledge to achieve the desired molecular
30 weight and are thus not explained in detail.

[0171]

When the pressure-sensitive adhesive composition contains an acrylic oligomer, the content thereof can be, for example, 0.01 parts by mass or more based on 100 parts by mass

of the base polymer, may be 0.05 parts by mass or more to obtain a higher effect and may be 0.1 parts by mass or more or 0.2 parts by mass or more.

[0172]

In view of the compatibility with the base polymer or the like, the acrylic oligomer content is generally suitably less than 50 parts by mass, preferably less than 30 parts by mass, more preferably 25 parts by mass or less and may be 10 parts by mass or less, 5 parts by mass or less or 1 part by mass or less.

[0173]

(Other Components)

Within the range in which the effects of the invention are not prevented, the pressure-sensitive adhesive composition in an embodiment of the invention can contain general additives in the field of pressure-sensitive adhesive compositions, such as a tackifier resin (for example, rosin-based, petroleum-based, terpene-based, phenolic and ketone-based tackifier resins and the like), a viscosity controller (for example, a thickener), a leveling agent, a plasticizer, a filler, a coloring agent such as a pigment and a dye, a stabilizer, a preservative and an anti-aging agent, as other optional components according to need. Conventionally known additives can be used by general methods, and the additives do not particularly characterize the invention and thus are not explained in detail.

[0174]

The technique according to the embodiment can exhibit excellent adhesion force without the use of the tackifier resin described above, and thus the tackifier resin content of the pressure-sensitive adhesive composition can be, for example, less than 10 parts by mass based on 100 parts by mass of the base polymer, further less than 5 parts by mass. The tackifier resin content may be less than 1 part by mass (for example, less than 0.5 parts by mass) and may be less than 0.1 parts by mass (0 part by mass or more and less than 0.1 parts by mass), and the pressure-sensitive adhesive composition can be a composition which does not contain the tackifier resin.

[0175]

To improve the transparency, with respect to the pressure-sensitive adhesive composition in an embodiment of the invention, the amount of the components other than the base polymer in the pressure-sensitive adhesive composition is preferably restricted. In the technique according to the embodiment, the amount of the components other than the base polymer in the pressure-sensitive adhesive composition is generally approximately 30

weight% or less, is suitably approximately 15 weight% or less and is preferably approximately 12 weight% or less (for example, approximately 10 weight% or less). The amount of the components other than the base polymer in the pressure-sensitive adhesive composition according to an embodiment may be approximately 5 weight% or less, may be approximately 3 weight% or less and may be approximately 1.5 weight% or less (for example, approximately 1 weight% or less). A composition in which the amount of the components other than the base polymer is restricted in this manner can be preferably applied to the pressure-sensitive adhesive composition in the embodiment.

[0176]

<Pressure-Sensitive Adhesive Layer>

The pressure-sensitive adhesive layer in an embodiment of the invention is formed from the pressure-sensitive adhesive composition. In Fig. 2, a schematic cross section of an example of the structure of the pressure-sensitive adhesive layer in an embodiment of the invention is illustrated.

[0177]

The pressure-sensitive adhesive layer can be a cured layer of the pressure-sensitive adhesive composition. That is, the pressure-sensitive adhesive layer can be formed by providing (for example, applying) the pressure-sensitive adhesive composition on an appropriate surface and then appropriately conducting curing treatment. When two or more types of curing treatment (drying, crosslinking, polymerization and the like) are conducted, the treatments can be conducted simultaneously or in multiple stages.

[0178]

For a pressure-sensitive adhesive composition using a partial polymer (polymer syrup) of the monomer components, final copolymerization reaction is typically conducted as the curing treatment. That is, a complete polymer is formed by further subjecting the partial polymer to copolymerization reaction. For example, photoirradiation is conducted for a photocurable pressure-sensitive adhesive composition. According to need, curing treatment such as crosslinking and drying may be conducted. For example, in the case of a photocurable pressure-sensitive adhesive composition which needs to be dried (for example, in the case of a photocurable pressure-sensitive adhesive composition in which a partial polymer of the monomer components is dissolved in an organic solvent), the composition is photocured after drying.

[0179]

For a pressure-sensitive adhesive composition using a complete polymer, treatment such as drying (drying by heating) and crosslinking is typically conducted as the curing treatment according to need. In the case of a solvent-type pressure-sensitive adhesive composition which has acquired photocuring property (photo-crosslinking property) due to addition of a polyfunctional monomer, the composition is photocured after drying. Here, after drying the composition may be after adhering the pressure-sensitive adhesive sheet described below obtained through drying to an adherend. The pressure-sensitive adhesive sheet described below can be used in an aspect in which the sheet is adhered to the adherend by a method including photocuring after adhering to the adherend.

[0180]

A pressure-sensitive adhesive layer having a multilayer structure of two or more layers can be produced by adhering pressure-sensitive adhesive layers which are formed in advance together. Alternatively, a pressure-sensitive adhesive composition may be applied onto a first pressure-sensitive adhesive layer which is formed in advance, and the pressure-sensitive adhesive composition may be cured to form a second pressure-sensitive adhesive layer. When the pressure-sensitive adhesive layer of the pressure-sensitive adhesive sheet described below which is used in an adhesion form of photocuring after adhering to an adherend has a multilayer structure, the pressure-sensitive adhesive layer which is photocured may be a part of the layers (for example, one of the layers) or all the layers included in the multilayer structure.

[0181]

The pressure-sensitive adhesive composition can be applied, for example, using a generally used coater such as a gravure roll coater, a reverse roll coater, a kiss-roll coater, a dip roll coater, a bar coater, a knife coater and a spray coater. In the case of a pressure-sensitive adhesive sheet having the base material described below, as the method for providing the pressure-sensitive adhesive layer on the base material, a direct method of directly providing the pressure-sensitive adhesive composition on the base material to form the pressure-sensitive adhesive layer may be used, and a transferring method of transferring a pressure-sensitive adhesive layer formed on a release surface onto the base material may also be used.

[0182]

The thickness of the pressure-sensitive adhesive layer is not particularly limited and can be, for example, around 3 μm to 2000 μm . In view of the close adhesiveness to the

adherend such as the step-following property, in some aspects, the thickness of the pressure-sensitive adhesive layer may be, for example, 5 μm or more, is suitably 10 μm or more and is preferably 20 μm or more, more preferably 30 μm or more. The thickness of the pressure-sensitive adhesive layer may be 50 μm or more, may exceed 50 μm , may be 70 μm or more, may be 100 μm or more and may be 120 μm or more.

[0183]

To prevent the occurrence of remaining glue due to a cohesive failure of the pressure-sensitive adhesive layer, in some aspects, the thickness of the pressure-sensitive adhesive layer may be, for example, 1000 μm or less, may be 700 μm or less, may be 500 μm or less and may be 300 μm or less, 200 μm or less or 170 μm or less. The technique according to the aspect can be preferably carried out also in a form of the pressure-sensitive adhesive sheet described below in which the thickness of the pressure-sensitive adhesive layer is 130 μm or less, 90 μm or less or 60 μm or less (for example, 40 μm or less). In the pressure-sensitive adhesive sheet described below having a pressure-sensitive adhesive layer having a multilayer structure of two or more layers, the thickness of the pressure-sensitive adhesive layer means the thickness from the pressure-sensitive adhesive surface that is adhered to an adherend to the surface opposite to the pressure-sensitive adhesive surface.

[0184]

<Pressure-Sensitive Adhesive Sheet>

The pressure-sensitive adhesive sheet in an embodiment of the invention has the pressure-sensitive adhesive layer. The pressure-sensitive adhesive sheet in the embodiment may be a base material-having pressure-sensitive adhesive sheet in the form having the pressure-sensitive adhesive layer on one surface or both surfaces of a base material sheet (support) and may also be a pressure-sensitive adhesive sheet having no base material in the form in which the pressure-sensitive adhesive layer is held on a release sheet or in another form. The concept of the pressure-sensitive adhesive sheet here can include those which are called a pressure-sensitive adhesive tape, a pressure-sensitive adhesive label, a pressure-sensitive adhesive film and the like.

[0185]

The pressure-sensitive adhesive layer is typically formed continuously but is not limited to the form, and, for example, the pressure-sensitive adhesive layer may be formed in a regular or random pattern of dots, stripes or the like. The pressure-sensitive adhesive sheet of the embodiment may be a roll and may be a sheet. Alternatively, a pressure-sensitive

adhesive sheet in the form of having been further processed in any of various shapes may also be used.

[0186]

(UV-Absorbing Layer)

5 The pressure-sensitive adhesive sheet in an embodiment of the invention can be in a form having a UV-absorbing layer on one surface of the pressure-sensitive adhesive layer. In Fig. 3, a schematic cross section of an example of the structure of the pressure-sensitive adhesive sheet in an embodiment of the invention which has a UV-absorbing layer on one surface of the pressure-sensitive adhesive layer is illustrated. The pressure-sensitive
10 adhesive sheet 1 illustrated in Fig. 3 has a pressure-sensitive adhesive layer 21 and a UV-absorbing layer 31 provided on one surface of the pressure-sensitive adhesive layer. The UV-absorbing layer 31 contains a UV absorber such as a UV-absorbing polymer.

[0187]

 Depending on the kind, the photooxidant or the photobase generator contained in
15 the pressure-sensitive adhesive sheet may generate an acid or a base by ultraviolet rays included in the sunlight and cause color change or coloration of the sheet. In this case, there is a problem because the color change or the coloration of the pressure-sensitive adhesive sheet at any timing by irradiation with an active energy ray becomes difficult. To prevent such a problem, the UV-absorbing layer is preferably provided as an anti-natural light
20 measure.

[0188]

 That is, by providing the UV-absorbing layer on the side of the pressure-sensitive adhesive layer which is irradiated with the sunlight, ultraviolet rays included in the sunlight can be prevented from reaching the pressure-sensitive adhesive layer, and as a result, the color
25 change or the coloration of the pressure-sensitive adhesive layer due to irradiation with the sunlight can be prevented. Also when the UV-absorbing layer is provided, the pressure-sensitive adhesive sheet can be changed in the color or colored by selecting an active energy ray which is not absorbed by the UV-absorbing layer and irradiating with the active energy ray at appropriate timing.

30 [0189]

 In the case where the energy for activating the photoacid generator and the photobase generator is absorbed by the UV-absorbing layer when the color change or the coloration is caused by irradiating with an active energy ray after adhering the UV-absorbing

layer to the pressure-sensitive adhesive layer, the active energy ray is preferably applied to the pressure-sensitive adhesive sheet from the surface opposite to the surface with the UV-absorbing layer so that the ultraviolet rays as the activation energy are not absorbed by the UV-absorbing layer.

5 [0190]

The UV-absorbing polymer used as the UV absorber can be preferably selected from polymers containing a structural unit having UV-absorbing property. Examples thereof include: 2-hydroxybenzophenone derivatives including 2-hydroxy-4-methoxybenzophenone, 2-hydroxy-4-octoxybenzophenone, 2-hydroxy-4-dodecyloxybenzophenone, 2-hydroxy-4-methoxy-5-sulfobenzophenone, 2,4-dihydroxybenzophenone, 2,2'-dihydroxy-4,4'-dimethoxybenzophenone, bis(2-methoxy-4-hydroxy-5-benzoylphenyl)methane, 2-hydroxy-4-acryloyloxybenzophenone, 2-hydroxy-4-methacryloyloxybenzophenone, 2-hydroxy-4-(2-acryloyloxy)ethoxybenzophenone, 2-hydroxy-4-(2-methacryloyloxy)ethoxybenzophenone, 2-hydroxy-4-(2-methyl-2-acryloyloxy)ethoxybenzophenone and the like; 2-hydroxybenzotriazole derivatives including 2-(2'-hydroxy-5'-methylphenyl)benzotriazole, 2-(2'-hydroxy-5'-t-butylphenyl)benzotriazole, 2-(2'-hydroxy-5'-3',5'-di-t-butylphenyl)benzotriazole, 2-(2'-hydroxy-3'-t-butyl-5'-methylphenyl)-5-chlorobenzotriazole, 2-(2'-hydroxy-3'-5'-di-t-amylphenyl)benzotriazole, 2-{2'-hydroxy-3'-(3'',4'',5'',6''-tetrahydrophthalimidemethyl-5'-methylphenyl)}benzotriazole, 2,2-methylene bis{4-(1,1,3,3-tetramethylbutyl)-6-(2H-benzotriazol-2-yl)phenol}, 2-{2'-hydroxy-5'-(methacryloyloxy)phenyl}benzotriazole, 2-[2'-hydroxy-5'-(acryloyloxy)phenyl]benzotriazole, 2-[2'-hydroxy-3'-t-butyl-5'-(methacryloyloxy)phenyl]benzotriazole, 2-[2'-hydroxy-3'-methyl-5'-(acryloyloxy)phenyl]benzotriazole, 2-{2'-hydroxy-5'-(methacryloyloxypropyl)phenyl}-5-chlorobenzotriazole, 2-[2'-hydroxy-5'-(methacryloyloxyethyl)phenyl]benzotriazole, 2-[2'-hydroxy-5'-(acryloyloxyethyl)phenyl]benzotriazole, 2-[2'-hydroxy-3'-t-butyl-5'-(methacryloyloxyethyl)phenyl]benzotriazole, 2-[2'-hydroxy-3'-methyl-5'-(acryloyloxyethyl)phenyl]benzotriazole, 2-[2'-hydroxy-5'-(methacryloyloxypropyl)phenyl]-5-chlorobenzotriazole, 2-[2'-hydroxy-5'-(acryloyloxybutyl)phenyl]-5-methylbenzotriazole, [2-hydroxy-3-t-butyl-5-(acryloyloxyethoxycarbonyl)ethyl]phenyl]benzotriazole and the like; and salicylic acid derivatives such as phenyl salicylate, p-t-butylphenyl salicylate and p-octylphenyl salicylate: although the UV-absorbing polymer is not limited to the examples.

[0191]

The UV-absorbing polymer preferably has the maximum absorption wavelength in the range of 300 to 400 nm.

[0192]

The UV-absorbing polymer is preferably a copolymer which is a reaction product of a mixture of a UV-absorbing vinyl monomer and one or more copolymerizable compatible vinyl monomers, and the UV-absorbing vinyl monomer here contains the structural unit having UV-absorbing property described above.

[0193]

Examples of the copolymerizable vinyl monomer include acrylic acid, alkyl acrylic acids (methacrylic acid or the like), esters or amides derived from acrylic acid (for example, acrylamide, methacrylamide, n-butylacrylamide, t-butylacrylamide, diacetone acrylamide, methyl acrylate, ethyl acrylate, n-propyl acrylate, n-butyl acrylate, t-butyl acrylate, isobutyl acrylate, 2-ethylhexyl acrylate, n-octyl acrylate, lauryl acrylate, 2-ethoxyethyl acrylate, 2-methoxyethyl acrylate, methyl methacrylate, ethyl methacrylate, n-butyl methacrylate, b-hydroxyl methacrylate and the like), vinyl esters (for example, vinyl acetate, vinyl propionate, vinyl laurate and the like), acrylonitrile, methacrylonitrile, aromatic vinyl compounds (for example, styrene and derivatives thereof, for example, vinyltoluene, divinylbenzene, vinyl acetophenone, sulfostyrene and the like), itaconic acid, citraconic acid, crotonic acid, vinylidene chloride, vinyl alkyl ethers (for example, vinyl ethylether and the like), maleic acid, N-vinyl-2-pyrrolidone, N-vinylpyridine, esters of 2- or 4-vinylpyridine and the like and sulfonic acid containing a monomer (for example, acrylamide-2,2'-dimethylpropanesulfonic acid, 2-sulfoethyl methacrylate, 3-sulfopropyl methacrylate and the like).

[0194]

Of the monomers, esters of acrylic acid, esters of methacrylic acid and aromatic vinyl compounds are preferable.

[0195]

Preferable specific examples of the comonomer include: butyl acrylate; 2-ethylhexyl acrylate; 2-ethoxyethyl acrylate; 2-methoxyethyl acrylate; acrylic acid; methacrylic acid; acrylamide; 2-hydroxyethyl acrylate; vinyl acetate; styrene; N-vinyl-2-pyrrolidone; 2-sulfoethyl methacrylate and metal salts thereof; and 2-acrylamide-2-methylpropanesulfonic acid and metal salts thereof.

[0196]

(UV Absorber-Containing Pressure-Sensitive Adhesive Layer)

The pressure-sensitive adhesive sheet in an embodiment of the invention can be in a form having a pressure-sensitive adhesive layer containing a UV absorber (also called “UV absorber-containing pressure-sensitive adhesive layer” or “UV absorptive pressure-sensitive adhesive layer” below) on one surface of the pressure-sensitive adhesive layer. In Fig. 4, a schematic cross section of an example of the structure of the pressure-sensitive adhesive sheet in an embodiment of the invention which has a UV absorber-containing pressure-sensitive adhesive layer on one surface of the pressure-sensitive adhesive layer is illustrated. The pressure-sensitive adhesive sheet 2 illustrated in Fig. 4 has a pressure-sensitive adhesive layer 21 and a UV absorber-containing pressure-sensitive adhesive layer 41 provided on one surface of the pressure-sensitive adhesive layer 21. As a result, a similar anti-natural light measure to that of the UV-absorbing layer can be made.

[0197]

As the UV absorber contained in the pressure-sensitive adhesive layer 41, those similar to the UV absorber above can be used. The pressure-sensitive adhesive layer 41 containing the UV absorber can contain a similar component to those of the pressure-sensitive adhesive layer in an embodiment of the invention described above.

[0198]

(Base Material)

The pressure-sensitive adhesive sheet according to some embodiments can be in the form of a base material-having pressure-sensitive adhesive sheet including a base material adhered to the back surface of the pressure-sensitive adhesive layer. In Fig. 5, a schematic cross section of an example of the structure of the pressure-sensitive adhesive sheet in an embodiment of the invention in which a pressure-sensitive adhesive layer is formed on one surface of a base material is illustrated. The pressure-sensitive adhesive sheet 3 illustrated in Fig. 5 has a base material 51 and a pressure-sensitive adhesive layer 21 formed on one surface of the base material.

[0199]

As the pressure-sensitive adhesive sheet according to another embodiment, a schematic cross section of an example of the structure in which pressure-sensitive adhesive layers are formed on both surfaces of a base material 51 is illustrated in Fig. 6. The pressure-sensitive adhesive sheet 4 illustrated in Fig. 6 has a base material 51 and a first pressure-sensitive adhesive layer 21 and a second pressure-sensitive adhesive layer 22 formed on both surfaces of the base material.

[0200]

The material of the base material is not particularly limited and can be appropriately selected depending on the purpose of use and the form of use of the pressure-sensitive adhesive sheet and the like. Nonlimiting examples of the base material which can be used include: plastic films including polyolefin films containing polyolefin as the main component such as polypropylene and an ethylene-propylene copolymer, polyester films containing polyester as the main component such as polyethylene terephthalate and polybutylene terephthalate, polyvinyl chloride films containing polyvinyl chloride as the main component and the like; foam sheets made of foam such as polyurethane foam, polyethylene foam and polychloroprene foam; single or mixed woven clothes and nonwoven clothes of fibrous substances (which can be natural fibers such as hemp and cotton, synthetic fibers such as polyester and vinylon, semisynthetic fibers such as acetate and the like); papers such as Japanese paper, fine paper, kraft paper and crepe paper; metal foils such as aluminum foil and copper foil; and the like. The base material may be a base material having a composite structure of the materials. Examples of the base material having such a composite structure include a base material having a laminated structure of a metal foil and the plastic film, a plastic sheet reinforced with inorganic fibers such as glass clothes and the like.

[0201]

As the base material of the pressure-sensitive adhesive sheet in an embodiment of the invention, a film (also called a support film below) can be preferably used. The support film may be a porous film like a foam film, a nonwoven cloth sheet or the like, may be a nonporous film and may be a film having a laminated structure of a porous layer and a nonporous layer.

[0202]

In some aspects, as the support film, a support film including a resin film which is capable of independently maintaining the shape (self-supporting or independent) as the base film can be preferably used. The “resin film” here means a resin film which has a nonporous structure and which typically does not substantially contain air bubbles (void-less). Therefore, the resin film is a concept distinguished from foam films and nonwoven clothes. The resin film may have a single layer structure and may have a multilayer structure of two or more layers (for example, a structure having three layers).

[0203]

As the resin material constituting the resin film, for example, resins including

polyester, polyolefin, polycycloolefin derived from a monomer having an aliphatic ring structure such as a norbornene structure, polyamides (PAs) such as nylon 6, nylon 66 and partially aromatic polyamide, polyimide (PI), polyamide-imide (PAI), polyether ether ketone (PEEK), polyether sulfone (PES), polyphenylene sulfide (PPS), polycarbonate (PC),
5 polyurethane (PU), an ethylene-vinyl acetate copolymer (EVA), polystyrene, polyvinyl chloride, polyvinylidene chloride, fluoro-resins such as polytetrafluoroethylene (PTFE), acrylic resins such as polymethyl methacrylate, cellulose-based polymers such as diacetyl cellulose and triacetyl cellulose, vinyl butyral-based polymers, arylate-based polymers, polyoxymethylene-based polymers, epoxy-based polymers and the like can be used.

10 [0204]

The resin film may be formed using a resin material containing a kind of such resins alone and may be formed using a resin material obtained by blending two or more kinds thereof. The resin film may be non-stretched or stretched (for example, uniaxially stretched or biaxially stretched).

15 [0205]

Preferable examples of the resin material constituting the resin film include a polyester-based resin, a PPS resin and a polyolefin-based resin. Here, the polyester-based resin refers to a resin containing polyester in a percentage exceeding 50 weight%. Similarly, the PPS resin refers to a resin containing PPS in a percentage exceeding 50 weight%, and the
20 polyolefin-based resin refers to a resin containing polyolefin in a percentage exceeding 50 weight%.

[0206]

As the polyester-based resin, a polyester-based resin containing polyester obtained by polycondensation of a dicarboxylic acid and a diol as the main component is typically
25 used. Specific examples of the polyester-based resin include polyethylene terephthalate (PET), polybutylene terephthalate (PBT), polyethylene naphthalate (PEN), polybutylene naphthalate and the like.

[0207]

As the polyolefin resin, a kind of polyolefin alone or a combination of two or more
30 kinds of polyolefin can be used. The polyolefin can be, for example, a homopolymer of α -olefin, a copolymer of two or more kinds of α -olefin, a copolymer of one, two or more kinds of α -olefin and another vinyl monomer or the like.

[0208]

Specific examples thereof include polyethylene (PE), polypropylene (PP), poly-1-butene, poly-4-methyl-1-pentene, ethylene-propylene copolymers such as ethylene propylene rubber (EPR), ethylene-propylene-butene copolymers, ethylene-butene copolymers, ethylene-vinyl alcohol copolymers, ethylene-ethyl acrylate copolymers and the like. Both low-
5 density (LD) polyolefin and high-density (HD) polyolefin can be used.

[0209]

Examples of the polyolefin resin film include a non-stretched polypropylene (CPP) film, a biaxially stretched polypropylene (OPP) film, a low-density polyethylene (LDPE) film, a linear low-density polyethylene (LLDPE) film, a medium-density polyethylene
10 (MDPE) film, a high-density polyethylene (HDPE) film, a polyethylene (PE) film obtained by blending two or more kinds of polyethylene (PE), a PP/PE blend film obtained by blending polypropylene (PP) and polyethylene (PE) and the like.

[0210]

Specific examples of the resin film which can be preferably used as the base
15 material include a PET film, a PEN film, a PPS film, a PEEK film, a CPP film and an OPP film. Preferable examples in view of the strength include a PET film, a PEN film, a PPS film and a PEEK film. A preferable example in view of the easy availability, the size stability, the optical properties and the like is a PET film.

[0211]

To the resin film, a known additive such as a light stabilizer, an antioxidant, an
20 antistatic agent, a coloring agent (a dye, a pigment or the like), a filler, a slip agent and an anti-blocking agent can be blended according to need. The amount of the additive blended is not particularly limited and can be appropriately determined depending on the use of the pressure-sensitive adhesive sheet and the like.

25 [0212]

The method for producing the resin film is not particularly limited. For example, a conventionally known general method for forming a resin film such as extrusion molding, inflation molding, T-die casting and calender roll forming can be appropriately employed.

[0213]

30 The base material can be substantially composed of such a resin film. Alternatively, the base material may be a base material containing a supplementary layer in addition to the resin film. Examples of the supplementary layer include an optical property-adjusting layer (for example, an antireflection layer), a print layer or a laminate layer for

providing desired appearance to the base material or the pressure-sensitive adhesive sheet, an antistatic layer, an undercoat layer and a surface treatment layer such as a release layer. The base material may be the optical member described below.

[0214]

5 The thickness of the base material is not particularly limited and can be selected depending on the purpose of use and the form of use of the pressure-sensitive adhesive sheet and the like. The thickness of the base material may be, for example, 1000 μm or less, may be 500 μm or less, may be 100 μm or less, may be 70 μm or less, may be 50 μm or less, may be 25 μm or less, may be 10 μm or less and may be 5 μm or less. When the thickness of the
10 base material becomes smaller, there is a tendency toward improvement of the flexibility of the pressure-sensitive adhesive sheet and the property of following the surface shape of the adherend.

[0215]

 In view of the handleability, the processability and the like, the thickness of the base
15 material may be, for example, 2 μm or more and may be more than 5 μm or more than 10 μm . In some aspects, the thickness of the base material may be, for example, 20 μm or more, may be 35 μm or more and may be 55 μm or more.

[0216]

 The surface of the base material which is adhered to the pressure-sensitive adhesive
20 layer may be subjected to conventionally known surface treatment such as corona discharge treatment, plasma treatment, ultraviolet radiation treatment, acid treatment, alkali treatment, application of an undercoat agent (primer) and antistatic treatment according to need. Such surface treatment can be treatment for improving the close adhesiveness between the base material and the pressure-sensitive adhesive layer, namely the anchoring property of the
25 pressure-sensitive adhesive layer to the base material. The composition of the primer is not particularly limited and can be appropriately selected from known primers. The thickness of the undercoat layer is not particularly restricted but is generally suitably around 0.01 μm to 1 μm and is preferably around 0.1 μm to 1 μm .

[0217]

30 The surface (also called the back surface below) of the base material which is opposite to the surface which is adhered to the pressure-sensitive adhesive layer may be subjected to conventionally known surface treatment such as release treatment, treatment for improving the adhesiveness or the pressure-sensitive adhesiveness and antistatic treatment

according to need. For example, when the back surface of the base material is subjected to surface treatment with a release treatment agent, the rewinding force of the pressure-sensitive adhesive sheet in the state of being wound in a roll can be reduced. As the release treatment agent, a silicone-based release treatment agent, a long-chain alkyl-based release treatment agent, an olefin-based release treatment agent, a fluorine-based release treatment agent, a fatty acid amide-based release treatment agent, molybdenum sulfide, silica powder or the like can be used.

[0218]

(Release Liner)

In the pressure-sensitive adhesive sheet in the embodiment, the pressure-sensitive adhesive layer or the UV absorber-containing pressure-sensitive adhesive layer may be protected with a release liner (a separator or a release film) until use.

[0219]

Generally used release paper or the like can be used as the release liner, and the release liner is not particularly limited. For example, however, a base material having a release-treated layer, a low-adhesion base material composed of a fluoropolymer, a low-adhesion base material composed of a nonpolar polymer or the like can be used.

[0220]

Examples of the base material having a release-treated layer include a plastic film, paper or the like which has been surface-treated with a silicone-based, long-chain alkyl-based, fluorine-based or molybdenum sulfide release treatment agent.

[0221]

Examples of the fluoropolymer in the low-adhesion base material composed of a fluoropolymer include polytetrafluoroethylene, polychlorotrifluoroethylene, polyvinyl fluoride, polyvinylidene fluoride, a tetrafluoroethylene-hexafluoropropylene copolymer, a chlorofluoroethylene-vinylidene fluoride copolymer and the like.

[0222]

Examples of the nonpolar polymer in the low-adhesion base material composed of a nonpolar polymer include an olefin-based resin (for example, polyethylene, polypropylene and the like) and the like. The release liner can be formed by a known or generally used method. The thickness of the release liner and the like are not particularly restricted.

[0223]

In the technique according to the embodiment, the haze value of the pressure-

sensitive adhesive sheet is suitably approximately 10% or less and can be approximately 5% or less (for example, approximately 3% or less). The haze value is preferably 1.0% or less. A pressure-sensitive adhesive sheet having such high transparency is preferable because the change in appearance after color change or coloration in the invention is remarkable. The haze value of the pressure-sensitive adhesive sheet may be less than 1.0%, may be less than 0.7% and may be 0.5% or less (for example, 0 to 0.5%). The haze values regarding the pressure-sensitive adhesive sheet can be preferably applied to the haze value of the pressure-sensitive adhesive layer in the technique according to the embodiment.

[0224]

The “haze value” here means the ratio of the diffuse transmitted light to the total transmitted light when visible light is applied to the object of the measurement. The haze value is also called a cloudiness value. The haze value can be represented by the following equation.

$$Th [\%] = Td/Tt \times 100$$

[0225]

In the equation, Th is the haze value [%], and Td is the scattered light transmittance. Tt is the total light transmittance. The haze value can be measured according to the method described in the Examples described below. The haze value can be adjusted, for example, by selecting the composition, the thickness or the like of the pressure-sensitive adhesive layer.

[0226]

The technique according to the embodiment can be preferably used, for example, for application for electronic parts, application for optical parts, application for building materials and the like.

EXAMPLES

[0227]

The embodiments of the invention are explained in more detail below using Examples.

[0228]

[Production of Pressure-Sensitive Adhesive Compositions] (Pressure-Sensitive Adhesive Composition A1)

To a reactor equipped with a cooling tube, a nitrogen introduction tube, a thermometer and a stirrer, 95 parts by weight of n-butylacrylate (BA) and 5 parts by weight of

acrylic acid (AA) as monomer components and 122 parts by weight of ethyl acetate as a polymerization solvent were charged, and 0.2 parts by weight of 2,2'-azobisisobutyronitrile (AIBN) was added as a thermal polymerization initiator. A solution containing an acrylic polymer 1 having Mw of 600000 was obtained through solution polymerization in nitrogen atmosphere.

[0229]

To the solution obtained above, per 100 parts by weight of the polymer component, 1 part by weight of 6-(diethylamino)-2-[(3-trifluoromethyl)anilino]xanthene-9-spiro-3'-phthalide as a leuco dye, 0.1 parts by weight of a propylene carbonate solution containing 50% active ingredients containing triarylsulfonium hexafluorophosphate as the main component (product name: CPI-100P, manufactured by San-Apro Ltd.) as a photoacid generator and 0.05 parts by weight based on the solid content of an epoxy-based crosslinking agent (1,3-bis(N,N-diglycidylaminomethyl)cyclohexane, product name: TETRAD C, manufactured by Mitsubishi Gas Chemical Company, Inc.) were added and uniformly mixed, and a pressure-sensitive adhesive composition A1 was thus prepared.

[0230]

(Pressure-Sensitive Adhesive Composition A2)

A pressure-sensitive adhesive composition A2 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A1 except that the amount of the photoacid generator used was 1 part by weight per 100 parts by weight of the polymer component.

[0231]

(Pressure-Sensitive Adhesive Composition A3)

A pressure-sensitive adhesive composition A3 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A1 except that the amount of the photoacid generator used was 5 parts by weight per 100 parts by weight of the polymer component.

[0232]

(Pressure-Sensitive Adhesive Composition A4)

A pressure-sensitive adhesive composition A4 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A1 except that the amount of the photoacid generator used was 10 parts by weight per 100 parts by weight of the polymer component.

[0233]

(Pressure-Sensitive Adhesive Composition A5)

A pressure-sensitive adhesive composition A5 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A1 except that the amount of the leuco dye used was 10 parts by weight per 100 parts by weight of the polymer component and that the amount of the photoacid generator used was 20 parts by weight.

[0234]

(Pressure-Sensitive Adhesive Composition A6)

A pressure-sensitive adhesive composition A6 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A1 except that the kind of the photoacid generator was triphenylsulfonium·nonafluorobutane-1-sulfonate (product name: ADEKA ARKLS SP-056, manufactured by ADEKA Corporation) and that the amount used was 1 part by weight.

[0235]

(Pressure-Sensitive Adhesive Composition A7)

A pressure-sensitive adhesive composition A7 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A6 except that the amount of the photoacid generator used was 5 parts by weight.

[0236]

(Pressure-Sensitive Adhesive Composition A8)

A pressure-sensitive adhesive composition A8 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A1 except that the photoacid generator was not used.

[0237]

(Pressure-Sensitive Adhesive Composition A9)

A pressure-sensitive adhesive composition A9 was prepared in the same manner as in the preparation of the pressure-sensitive adhesive composition A2 except that the leuco dye was not used.

[0238]

<Production of Pressure-Sensitive Adhesive Sheets>

(Example 1)

The pressure-sensitive adhesive composition A1 was applied to a release film R1 (Mitsubishi Plastics, Inc., MRF#38) having a thickness of 38 μm in which one surface of a

polyester film was a release surface and dried at 135°C for two minutes, and a pressure-sensitive adhesive layer B1 having a thickness of 50 μm was thus formed. A release film R2 (Mitsubishi Plastics, Inc., MRE#38) having a thickness of 38 μm in which one surface of a polyester film was a release surface was adhered to the pressure-sensitive adhesive layer B1, and a pressure-sensitive adhesive sheet of Example 1 in which the film R2, the pressure-sensitive adhesive layer B1 and the release film R1 were layered in this order was thus obtained.

[0239]

(Example 2)

A pressure-sensitive adhesive sheet of Example 2 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A2 was used instead of the pressure-sensitive adhesive composition A1.

[0240]

(Example 3)

A pressure-sensitive adhesive sheet of Example 3 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A3 was used instead of the pressure-sensitive adhesive composition A1.

[0241]

(Example 4)

A pressure-sensitive adhesive sheet of Example 4 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A4 was used instead of the pressure-sensitive adhesive composition A1.

[0242]

(Example 5)

A pressure-sensitive adhesive sheet of Example 5 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A5 was used instead of the pressure-sensitive adhesive composition A1.

[0243]

(Example 6)

A pressure-sensitive adhesive sheet of Example 6 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A6 was used instead of the pressure-sensitive adhesive composition A1.

(Example 7)

A pressure-sensitive adhesive sheet of Example 7 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A7 was used instead of the pressure-sensitive adhesive composition A1.

[0244]

5 (Example 8)

The release film R2 of the pressure-sensitive adhesive sheet produced in Example 2 was removed, and 100 μm of a pressure-sensitive adhesive tape having UV-absorbing function (Nitto Denko Corporation, product name: CS9934U) was adhered. A pressure-sensitive adhesive sheet of Example 8 having a UV-absorbing layer was thus produced.

10 [0245]

(Comparative Example 1)

A pressure-sensitive adhesive sheet of Comparative Example 1 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A8 was used instead of the pressure-sensitive adhesive composition A1.

15 [0246]

(Comparative Example 2)

A pressure-sensitive adhesive sheet of Comparative Example 2 was produced in the same manner as in Example 1 except that the pressure-sensitive adhesive composition A9 was used instead of the pressure-sensitive adhesive composition A1.

20 [0247]

<Measurement of Pressure-Sensitive Adhesion Forces>

(Pressure-Sensitive Adhesion Forces Before UV Irradiation)

The pressure-sensitive adhesion forces (initial) before UV irradiation of the pressure-sensitive adhesive sheets of Examples 1 to 7 and Comparative Examples 1 and 2 produced above were measured. The pressure-sensitive adhesion forces were measured by the following procedures.

25

First, each pressure-sensitive adhesive sheet was cut into pieces having a width of 20 mm and a length of 10 cm, and the release film was removed. Subsequently, the pressure-sensitive adhesive sheet of an example was adhered to a blue-plate glass having a thickness of 1.2 mm by applying pressure back and force twice with a 2-kg roller. The force for tearing off at a peel angle of 180 degrees and a peel speed of 300 mm/min was measured using a tension tester (AUTOGRAPH AGS-X, manufactured by Shimadzu Corporation) as the pressure-sensitive adhesion force (N/20 mm). The results are shown in Table 1.

30

[0248]

(Pressure-Sensitive Adhesion Forces after UV Irradiation)

The pressure-sensitive adhesion forces (after trigger) after UV irradiation of the pressure-sensitive adhesive sheets of Examples 1 to 7 and Comparative Examples 1 and 2 were measured. The pressure-sensitive adhesion forces after UV irradiation were measured by the same operations as those above except that UV (wavelength range: 200 to 400 nm) was applied after adhering a pressure-sensitive adhesive sheet to a blue-plate glass having a thickness of 1.2 mm with pressure.

For the UV irradiation, light was applied in an environment of 23°C, 50% RH through the alkali glass plate. More specifically, ultraviolet rays of a cumulative light amount of 2000 mJ/cm² were applied using a high-pressure mercury lamp (300 mW/cm²), and thus 6-(diethylamino)-2-[(3-trifluoromethyl)anilino]xanthene-9-spiro-3'-phthalide and triarylsulfonium-PF₆ salt contained in the pressure-sensitive adhesive sheet according to each example were reacted. The results are shown in Table 1.

[0249]

<Optical Characteristics Test>

In this test, the coloration of the pressure-sensitive adhesive sheets by UV irradiation was evaluated with the changes in the transmittance through the coloration.

Using a spectrophotometer U4100 manufactured by Hitachi High-Technologies Corporation, the total light transmittances at 380 to 780 nm of the pressure-sensitive adhesive sheets of Examples 1 to 7 and Comparative Examples 1 and 2 which were adhered to blue-plate glasses having a thickness of 1.2 mm were measured with a pitch of 5 nm. The measurement was made before the UV treatment and after the UV treatment (UV wavelength range: 200 to 400 nm), and the "changes (%)" in transmittance" which were the values at which the changes in the transmittance through the UV treatment were the highest were determined. The results are shown in Table 1.

<Weather Resistance Test>

In this test, the weather resistances to light corresponding to the ultraviolet rays in the natural light due to the presence or absence of the UV-absorbing layer were evaluated.

Using a super xenon weather meter SX75 manufactured by Suga Test Instruments Co., Ltd., light with the output of 120 W in the wavelength band of 300 to 400 nm (corresponding to the ultraviolet rays in the natural light) was applied to the pressure-sensitive adhesive sheets which were obtained in Example 2 and Example 8 and which were adhered to

blue-plate glasses having a thickness of 1.2 mm using a super xenon lamp for an hour. The light was applied to Example 8, which had the UV-absorbing layer, from the side of the UV-absorbing layer. The “changes (%) in transmittance” were then measured in the same manner as that above, and the results are shown in Table 2.

[0250]

[Table 1]

Table 1

	Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Comparative Example 1	Comparative Example 2
Pressure-Sensitive Adhesive Composition	A1	A2	A3	A4	A5	A6	A7	A8	A9
Base Polymer (Parts by Weight)	100	100	100	100	100	100	100	100	100
Leuco Dye (Parts by Weight)	1	1	1	1	10	1	1	1	0
6-(Diethylamino)-2-[(3-trifluoromethyl)anilino]xanthene-9-spiro-3'-phthalide									
Photoacid Generator (Parts by Weight)	0.1	1	5	10	20	0	0	0	1
CPI-100P									
SP-056	0	0	0	0	0	1	5	0	0
Epoxy Crosslinking Agent (Parts by Weight)	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
TETRAD C									
Presence or Absence of UV-Absorbing Layer	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent
Change (%) in Transmittance	5	48	92	95	99	33	66	1	1
Pressure-Sensitive Adhesion Force (N) Before UV Irradiation	10	10	10	10	10.5	10	10	9	9
Pressure-Sensitive Adhesion Force (N) After UV Irradiation	10	10	10	10	10.5	10	10	9	9

[0251]

[Table 2]

Table 2

		Example 2	Example 8
Pressure-Sensitive Adhesive Composition		A2	A2
Base Polymer (Parts by Weight)	Acrylic Polymer 1	100	100
Leuco Dye (Parts by Weight)	6-(Diethylamino)-2-[(3-trifluoromethyl)anilino]xanthene-9-spiro-3'-phthalide	1	1
Photoacid Generator (Parts by Weight)	CPI-100P	1	1
	SP-056	0	0
Epoxy Crosslinking Agent (Parts by Weight)	TETRAD C	0.05	0.05
Presence or Absence of UV-Absorbing Layer		Absent	Present
Change (%) in Transmittance after 1-Hour SXel Irradiation		57	2

5 [0252]

The transmittances of the pressure-sensitive adhesive sheets of Examples 1 to 7, which contained a leuco dye and a photooxidation generator, changed by the UV irradiation. Therefore, the pressure-sensitive adhesive sheets of the invention containing a leuco dye and a photooxidation generator could be changed in the color or colored at any timing by irradiation with an active energy ray.

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On the other hand, the transmittances of the pressure-sensitive adhesive sheets of Comparative Examples 1 and 2, which did not contain any leuco dye or any photooxidation generator, hardly changed by the UV irradiation.

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In this regard, the pressure-sensitive adhesion forces of the pressure-sensitive adhesive sheets of Examples 1 to 7 and Comparative Examples 1 and 2 did not change by the UV irradiation.

[0253]

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Moreover, the change in transmittance of the pressure-sensitive adhesive sheet of Example 8, which had a UV-absorbing layer on a pressure-sensitive adhesive layer containing a leuco dye and a photooxidation generator, was reduced as compared to that of the pressure-sensitive adhesive sheet of Example 2, which did not have any UV-absorbing layer, and the weather resistance thereof improved.

[0254]

Although preferable embodiments of the invention have been explained above, the invention is not restricted to the embodiments described above, and various changes and substitutions can be added to the embodiments described above within the scope which does not deviate from the scope of the invention.

The present application is based on a Japanese patent application filed on March 15, 2019 (patent application No. 2019-048841) and a Japanese patent application filed on March 9, 2020 (patent application No. 2020-039643), and the contents thereof are incorporated in the present application by reference.

REFERENCE SIGNS LIST

[0255]

1, 2, 3 and 4. Pressure-sensitive adhesive sheet

21 and 22. Pressure-sensitive adhesive layer

31. UV-absorbing layer

41. UV absorber-containing pressure-sensitive adhesive layer

51. Base material

CLAIMS

[Claim 1]

5 A pressure-sensitive adhesive composition containing a base polymer, a leuco dye and a photoacid generator.

[Claim 2]

The pressure-sensitive adhesive composition according to claim 1, wherein the absorption wavelength of the leuco dye changes with the pH.

[Claim 3]

10 The pressure-sensitive adhesive composition according to claim 1 or 2 which contains 0.1 to 30 parts by mass of the leuco dye per 100 parts by mass of the base polymer.

[Claim 4]

15 The pressure-sensitive adhesive composition according to any one of claims 1 to 3, wherein the leuco dye is at least one dye selected from the group consisting of a phthalide dye and a fluoran dye.

[Claim 5]

The pressure-sensitive adhesive composition according to any one of claims 1 to 4 which contains 0.1 to 30 parts by mass of the photoacid generator per 100 parts by mass of the base polymer.

20 [Claim 6]

The pressure-sensitive adhesive composition according to any one of claims 1 to 5, wherein the photoacid generator is at least one compound selected from the group consisting of a sulfonium salt compound, an iodonium salt compound and an aromatic N-oxyimidosulfonate.

25 [Claim 7]

The pressure-sensitive adhesive composition according to any one of claims 1 to 6, wherein the base polymer contains an acrylic polymer.

[Claim 8]

30 The pressure-sensitive adhesive composition according to any one of claims 1 to 7 which changes in the color by irradiation with an active energy ray.

[Claim 9]

The pressure-sensitive adhesive composition according to any one of claims 1 to 7 which is colored by irradiation with an active energy ray.

[Claim 10]

A pressure-sensitive adhesive layer containing the pressure-sensitive adhesive composition according to any one of claims 1 to 9.

[Claim 11]

5 A pressure-sensitive adhesive sheet having the pressure-sensitive adhesive layer according to claim 10.

[Claim 12]

The pressure-sensitive adhesive sheet according to claim 11 having a UV-absorbing layer on one surface of the pressure-sensitive adhesive layer.

10 [Claim 13]

The pressure-sensitive adhesive sheet according to claim 12, wherein the UV-absorbing layer is a pressure-sensitive adhesive layer containing a UV absorber.

[Claim 14]

15 The pressure-sensitive adhesive sheet according to any one of claims 11 to 13, wherein the pressure-sensitive adhesive layer is formed on a base material.