

PRESSURE SENSITIVE ADHESIVE SHEET, PRESSURE SENSITIVE ADHESIVE-EQUIPPED OPTICAL FILM, AND METHOD FOR MANUFACTURING IMAGE DISPLAY DEVICE

5 TECHNICAL FIELD

[0001] The present invention relates to a pressure sensitive adhesive sheet and pressure sensitive adhesive-equipped optical film. The invention also relates to a method for manufacturing an image display device using the pressure sensitive adhesive sheet.

10 BACKGROUND ART

[0002] Liquid crystal displays and organic EL displays are widely used as various kinds of image display devices of mobile phones, car navigation devices, personal computer monitors, televisions and so on. On a viewing-side outermost surface of an image display panel, a front transparent plate (also referred to as a “cover window” etc.) such as a transparent resin plate or a glass plate may be provided, for the purpose of, for example, preventing damage to the image display panel due to impact from the outer surface. In addition, display devices provided with a touch panel on front surface of an image display panel become common recently.

[0003] In an image display device including a front transparent member such as a front transparent plate or a touch panel arranged on a front surface of an image display panel, the front transparent member and the image display panel are bonded with a pressure sensitive adhesive sheet interposed therebetween. A colored layer (decorative printed layer) may be formed on the peripheral edge of a front transparent member for the purpose of decoration and light shielding. When a pressure sensitive adhesive is bonded to a transparent member having a decorative printed layer, bubbles are easily generated on the periphery of a printing level difference portion.

[0004] For solving problems caused by a printing level difference of a front transparent member as described above, a soft and thick pressure sensitive adhesive sheet is used for bonding the front transparent plate, so that level difference absorbency is imparted. For example, Patent Document 1 describes an image display in which an image display panel and a cover window having a printing level difference are bonded to each other using a photocurable pressure sensitive adhesive sheet containing a base polymer, a photopolymerizable polyfunctional monomer and a photopolymerization initiator. The

photocurable pressure sensitive adhesive is soft, and has excellent level difference followability before curing, and exhibits excellent bonding reliability after photocuring.

[0005] Sunlight, light from a fluorescent lamp or the like in a storage environment may cause progression of photocuring of a photocurable pressure sensitive adhesive sheet.

- 5 Progression of photocuring hardens the pressure sensitive adhesive, resulting in insufficient level difference followability. Patent Document 2 suggests that a release film having ultraviolet absorbability is bonded to a surface of a pressure sensitive adhesive sheet to suppress photocuring of the pressure sensitive adhesive sheet in a storage environment. Further, Patent Document 2 suggests that by adding an ultraviolet
10 absorber to a pressure sensitive adhesive composition to impart ultraviolet absorbability, degradation of image display device constituent members such as organic EL elements and polarizers can be suppressed.

PRIOR ART DOCUMENTS

- 15 [0006] Patent Document 1: JP 2014-227453 A
Patent Document 2: JP 2017-173479 A

SUMMARY OF THE INVENTION

PROBLEMS TO BE SOLVED BY THE INVENTION

- 20 [0007] In a process for producing a pressure sensitive adhesive sheet, a pressure sensitive adhesive composition may be photocured in a state in which a release film is laminated. When an ultraviolet ray is applied through a release film having ultraviolet absorbability, photocuring is difficult to progress due to low light utilization efficiency. Thus, it is necessary that a release film having no ultraviolet absorbability be laminated
25 during photocuring, and replaced by a release film having ultraviolet absorbability after photocuring, leading to complication of the process and cost increase.

- [0008] In Patent Document 2, photocuring hindrance caused by an ultraviolet absorber is suppressed by imparting ultraviolet absorbability to a pressure sensitive adhesive layer and using a photopolymerization initiator having a sensitivity in a visible light region.
30 However, when a photopolymerization initiator having a high sensitivity to visible light is used, a pressure sensitive adhesive sheet is colored due to absorption of light by the photopolymerization initiator, resulting in deterioration of visibility of an image display device.

[0009] In view of the situations described above, an object of the present invention is to provide a photocurable pressure sensitive adhesive sheet which is inhibited from being photocured by light from a fluorescent lamp or the like in a storage environment, and has excellent transparency.

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MEANS FOR SOLVING THE PROBLEMS

[0010] The pressure sensitive adhesive sheet of the present invention is obtained by depositing a pressure sensitive adhesive composition in a layer-form, wherein the pressure sensitive adhesive is photocurable and contains a base polymer, a photopolymerizable polyfunctional compound, a photopolymerization initiator and an ultraviolet absorber. The pressure sensitive adhesive sheet has a light transmittance of preferably 85% or more at a wavelength of 420 nm, a light transmittance of preferably 80% or more at a wavelength of 405 nm, and a light transmittance of preferably 4 to 25% at a wavelength of 380 nm. The light transmittance of the pressure sensitive adhesive sheet at a wavelength of 365 nm is preferably 1% or less.

[0011] As the base polymer may be an acryl-based polymer. The base polymer preferably has a crosslinked structure. For example, the base polymer contains a hydroxy group-containing component as a monomer unit, and an isocyanate crosslinker is bonded to the hydroxy group to form a crosslinked structure.

[0012] The photopolymerizable polyfunctional compound has two or more photopolymerizable functional groups per molecule, and a polyfunctional (meth)acrylate or the like is used. The content of the polymerizable polyfunctional compound in the pressure sensitive adhesive composition which forms the pressure sensitive adhesive sheet may be about 0.3 to 10 parts by weight based on 100 parts by weight of the base polymer.

[0013] The photopolymerization initiator is preferably one having low absorption of visible light, and a light absorption coefficient is preferably 50 [mLg⁻¹cm⁻¹] or less at a wavelength of 405 nm. The light absorption coefficient of the photopolymerization initiator at a wavelength of 380 nm is preferably 80 [mLg⁻¹cm⁻¹] or more. The photopolymerization initiator is preferably one having an absorption maximum in the wavelength range of 310 nm to 370 nm.

[0014] Preferably, the pressure sensitive adhesive composition which forms the pressure sensitive adhesive sheet contains 0.05 to 1 part by weight of a photopolymerization initiator based on 100 parts by weight of the base polymer. The product of the content

w (parts by weight) of the photopolymerization initiator based on 100 parts by weight of the base polymer and the light absorption coefficient ε ($\text{mLg}^{-1}\text{cm}^{-1}$) of the photopolymerization initiator at a wavelength of 380 nm is preferably 10 to 100. The product εwT of the light transmittance T (%) of the pressure sensitive adhesive sheet at a wavelength of 380 nm and the value εw is preferably 100 to 1200.

[0015] The ultraviolet absorber may be a triazine-based compound, a benzotriazole-based compound or the like.

[0016] The gel fraction of the pressure sensitive adhesive sheet is preferably 30 to 80%. The gel fraction of the pressure sensitive adhesive sheet after the pressure sensitive adhesive sheet is photocured by application of an ultraviolet ray at 1000 mJ/cm^2 is preferably higher by 5% or more than the gel fraction before the photocuring.

[0017] The pressure sensitive adhesive sheet can be provided as a release film-equipped pressure sensitive adhesive sheet in which a release film is temporarily attached on both surfaces. Further, a pressure sensitive adhesive-equipped optical film may be formed in which the pressure sensitive adhesive sheet is laminated on one surface of an optical film such as a polarizing plate. The pressure sensitive adhesive-equipped optical film may be one in which a pressure sensitive adhesive sheet is laminated on both surfaces of an optical film.

[0018] The pressure sensitive adhesive sheet can be used for forming an image display device in which a transparent member having a level difference portion is disposed on a viewing-side surface. Bonding reliability can be improved by irradiating the pressure sensitive adhesive sheet with an active ray to photocure the pressure sensitive adhesive composition after bonding the pressure sensitive adhesive sheet to the transparent member having a level difference portion.

EFFECTS OF THE INVENTION

[0019] The pressure sensitive adhesive sheet of the present invention has ultraviolet ray-curable pressure sensitive adhesive. An ultraviolet ray-curable pressure sensitive adhesive is used for bonding an image display panel to a front transparent member such as a front transparent plate or a touch panel, resulting in exhibition of high fluidity and level difference followability during bonding, and curing with an ultraviolet ray is performed after bonding, resulting in enhancement of bonding reliability. The pressure sensitive adhesive composition contains an ultraviolet absorber, and thus it is possible to

suppress a photocuring reaction caused by light from a fluorescent lamp or the like in a storage environment.

BRIEF DESCRIPTION OF THE DRAWINGS

5 [0020] FIG. 1 is a sectional view showing an example of a configuration of a release film-equipped pressure sensitive adhesive sheet.

FIG. 2 is a sectional view showing an example of a configuration of an image display device.

10 FIGS. 3 and 4 are sectional views showing an example of a stacking configuration of a pressure sensitive adhesive-equipped optical film.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0021] FIG. 1 shows a release film-equipped pressure sensitive adhesive sheet in which release films 1 and 2 are temporarily attached, respectively, to both surfaces of a pressure sensitive adhesive sheet 5. The pressure sensitive adhesive sheet 5 is obtained by depositing a pressure sensitive adhesive composition in a sheet shape. The pressure sensitive adhesive composition contains a base polymer having a crosslinked structure, a photopolymerizable polyfunctional compound and a photopolymerization initiator. The pressure sensitive adhesive sheet is photocurable. Preferably, the pressure sensitive adhesive sheet has high transparency. The total light transmittance of the pressure sensitive adhesive sheet is preferably 85% or more, more preferably 90% or more. The haze of the pressure sensitive adhesive sheet is preferably 1.5% or less, more preferably 1% or less.

[0022] The thickness of the pressure sensitive adhesive sheet is not particularly limited, and may be set according to the type, shape and the like of an adherend. When a member having a printing level difference, such as a cover window with decorative printing, is used as the adherend, the thickness of the pressure sensitive adhesive sheet is preferably greater than the thickness of the printing level difference. The thickness of the pressure sensitive adhesive sheet to be used for bonding an adherend such as a decorative printed cover window is preferably 30 μm or more, more preferably 40 μm or more, further preferably 50 μm or more. When the thickness of the pressure sensitive adhesive sheet is increased, the level difference absorptency tends to be improved. The upper limit of the thickness of the pressure sensitive adhesive sheet is not particularly limited, but is

preferably 500 μm or less, more preferably 300 μm or less, further preferably 250 μm or less from the viewpoint of, for example, productivity of the pressure sensitive adhesive sheet.

[0023] The pressure sensitive adhesive sheet may be a monolayer structure or a multilayer structure in which a plurality of pressure sensitive adhesive layers are laminated. When the pressure sensitive adhesive sheet has a multilayer structure, at least one layer may be composed of a photocurable pressure sensitive adhesive composition containing an ultraviolet absorber. A plurality of pressure sensitive adhesive layers may be each composed of a photocurable pressure sensitive adhesive composition containing an ultraviolet absorber.

[0024] [Compositions of Pressure Sensitive Adhesive]

Composition of the pressure sensitive adhesive is not particularly limited, and pressure sensitive adhesives containing a base polymer such as an acryl-based polymer, a silicone-based polymer, a polyester, a polyurethane, a polyamide, a polyvinyl ether, a vinyl acetate/vinyl chloride copolymer, a modified polyolefin, an epoxy-based polymer, a fluorine-based polymer, or a polymer based on a rubber such as a natural rubber or a synthetic rubber can be appropriately selected. Particularly, an acryl-based pressure sensitive adhesive is preferably used because it is excellent in optical transparency, exhibits moderate wettability, cohesive strength and pressure sensitive adhesive properties such as adhesiveness, and is also excellent in weather resistance, heat resistance and the like.

[0025] <Base Polymer >

The acryl-based base polymer contains a (meth)acrylic acid alkyl ester as a main constituent monomer component. In this specification, the “(meth)acryl” means acryl and/or methacryl.

[0026] As the (meth)acrylic acid alkyl ester, a (meth)acrylic acid alkyl ester with the alkyl group having 1 to 20 carbon atoms is preferably used. The alkyl group of the (meth)acrylic acid alkyl ester may have a branch or may have a cyclic alkyl group.

[0027] Specific examples of the (meth)acrylic acid alkyl ester having a linear or branched alkyl group include methyl (meth)acrylate, ethyl (meth)acrylate, butyl (meth)acrylate, isobutyl (meth)acrylate, s-butyl (meth)acrylate, t-butyl (meth)acrylate, pentyl (meth)acrylate, isopentyl (meth)acrylate, neopentyl (meth)acrylate, hexyl (meth)acrylate, heptyl (meth)acrylate, 2-ethylhexyl (meth)acrylate, octyl (meth)acrylate, isooctyl (meth)acrylate, nonyl (meth)acrylate, isononyl (meth)acrylate, decyl (meth)acrylate,

isodecyl (meth)acrylate, undecyl (meth)acrylate, dodecyl (meth)acrylate, isotridodecyl (meth)acrylate, tetradecyl (meth)acrylate, isotetradecyl (meth)acrylate, pentadecyl (meth)acrylate, cetyl (meth)acrylate, heptadecyl (meth)acrylate, octadecyl (meth)acrylate, isooctadecyl (meth)acrylate, nonadecyl (meth)acrylate and aralkyl (meth)acrylate.

5 **[0028]** Specific examples of the (meth)acrylic acid alkyl ester having a cycloaliphatic alkyl group include (meth)acrylic acid cycloalkyl esters such as cyclopentyl (meth)acrylate, cyclohexyl (meth)acrylate, cycloheptyl (meth)acrylate and cyclooctyl (meth)acrylate; (meth)acrylic acid esters having a dicyclic aliphatic hydrocarbon ring, such as isobornyl (meth)acrylate; and (meth)acrylic acid esters having a tri-or-more-cyclic aliphatic
10 hydrocarbon ring, such as dicyclopentanyl (meth)acrylate, dicyclopentanyloxyethyl (meth)acrylate, tricyclopentanyl (meth)acrylate, 1-adamantyl (meth)acrylate, 2-methyl-2-adamantyl (meth)acrylate and 2-ethyl-2-adamantyl (meth)acrylate.

[0029] The amount of the (meth)acrylic acid alkyl ester based on the total amount of monomer components for forming an acryl-based base polymer is preferably 40% by
15 weight or more, more preferably 50% by weight or more, further preferably 60% by weight or more. From the viewpoint of ensuring that the glass transition temperature (T_g) of the base polymer is within an appropriate range, the amount of the (meth)acrylic acid alkyl ester having a linear or branched alkyl group having 4 to 10 carbon atoms based on the total amount of constituent monomer components in the acryl-based base polymer is
20 preferably 30% by weight or more, more preferably 40% by weight or more, further preferably 45% by weight or more.

[0030] The acryl-based base polymer preferably contains an acryl-based monomer unit having a crosslinkable functional group as a copolymer component. When the base polymer contains a crosslinkable functional group, the base polymer can be reacted with
25 the crosslinker to adjust the gel fraction of the pressure sensitive adhesive within a desired range.

[0031] Examples of the acryl-based monomer having a crosslinkable functional group include hydroxy group-containing monomers and carboxy group-containing monomers. For example, when an isocyanate-based crosslinker is used, a crosslinked structure is
30 introduced by reaction of a hydroxy group with an isocyanate group. When an epoxy-based crosslinker is used, a crosslinked structure is introduced by reaction of a carboxy group with an epoxy group. It is preferable that in particular, a hydroxy group-containing monomer is used as a copolymerization component for the base polymer, and a crosslinked

structure is introduced by an isocyanate-based crosslinker. When the base polymer includes a hydroxy group-containing monomer as a monomer unit, the crosslinkability of the base polymer is improved, and cloudiness of the pressure sensitive adhesive under a high-temperature and high-humidity environment tends to be suppressed, so that a pressure sensitive adhesive having high transparency is obtained.

[0032] Examples of the hydroxyl group-containing monomer include (meth)acrylic acid esters such as 2-hydroxyethyl (meth)acrylate, 2-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. Among them, 2-hydroxyethyl acrylate and 4-hydroxybutyl acrylate are preferable because they considerably contribute to enhancement of adhesive strength, and can suppress cloudiness of the pressure sensitive adhesive sheet in a high-humidity environment.

[0033] The amount of the hydroxy group-containing monomer based on the total amount of monomer components for forming the acryl-based base polymer is preferably 3 to 40% by weight, more preferably 5 to 30% by weight, further preferably 8 to 25% by weight. When the amount of the hydroxy group-containing monomer is increased, the amount of unreacted functional groups in the crosslinker decreases, so that with a small amount of the crosslinker, the gel fraction can be enhanced to secure both the processability and the level difference absorbency of the pressure sensitive adhesive sheet before photocuring.

[0034] Examples of the carboxy group-containing monomer include acryl-based monomers such as (meth)acrylic acid, carboxyethyl (meth)acrylate and carboxypentyl (meth)acrylate, and unsaturated fatty acids such as itaconic acid, maleic acid, fumaric acid and crotonic acid.

[0035] When the pressure sensitive adhesive sheet is used for bonding a touch panel sensor, it is preferable that a pressure sensitive adhesive sheet has a low acid content for preventing corrosion of the electrode by acid components. The content of organic acid monomers, *e.g.*, (meth)acrylic acid, in such an acid-free pressure sensitive adhesive sheet is preferably 100 ppm or less, more preferably 70 ppm or less, further preferably 50 ppm or less. The organic acid monomer content of the pressure sensitive adhesive sheet can be determined by immersing the pressure sensitive adhesive sheet in pure water, heating the pressure sensitive adhesive sheet at 100°C for 45 minutes, and determining the amount of acid monomers extracted in water by ion chromatography.

[0036] For reducing the content of acid monomers in the pressure sensitive adhesive sheet, the amount of organic acid monomer components such as (meth)acrylic acid in the monomer components that form the acryl-based base polymer is preferably small. Thus, for ensuring that the pressure sensitive adhesive sheet is free from acid, it is preferable that the base polymer does not substantially contain an organic acid monomer (carboxy group-containing monomer) as a monomer component. In the acid-free pressure sensitive adhesive sheet, the amount of the carboxy group-containing monomer is preferably 0.5 parts by weight or less, more preferably 0.1 parts by weight or less, further preferably 0.05 parts by weight or less, ideally 0 parts by weight based on 100 parts by weight of the total of monomer components in the base polymer.

[0037] The acryl-based base polymer may contain a nitrogen-containing monomer as the constituent monomer component. Examples of the nitrogen-containing monomer include vinyl-based monomer such as N-vinylpyrrolidone, methylvinylpyrrolidone, vinylpyridine, vinylpiperidone, vinylpyrimidine, vinylpiperazine, vinylpyrazine, vinylpyrrole, vinylimidazole, vinyloxazole, vinylmorpholine, (meth)acryloylmorpholine, N-vinylcarboxylic acid amides and N-vinylcaprolactam; and cyano group-containing acryl-based monomers such as acrylonitrile and methacrylonitrile. Among them, N-vinylpyrrolidone is preferable because it considerably contribute to enhancement of adhesive strength by improvement of cohesive force.

[0038] When the acryl-based base polymer contains high-polarity monomers such as a hydroxyl group-containing monomer, a carboxy group-containing monomer and a nitrogen-containing monomer as constituent monomer components, the cohesive force of the pressure sensitive adhesive tends to be enhanced, leading to improvement of adhesion retainability. The amount of high-polarity monomers (total of a hydroxyl group-containing monomer, a carboxy group-containing monomer and a nitrogen-containing monomer) based on the total amount of monomer components for forming the acryl-based base polymer is preferably 10 to 60% by weight, more preferably 15 to 50% by weight, further preferably 18 to 40% by weight. In addition, the amount of the nitrogen-containing monomer based on the total amount of monomer components for forming the acryl-based base polymer is preferably 3 to 25% by weight, more preferably 5 to 20% by weight, further preferably 7 to 15% by weight.

[0039] Besides the above-described monomer components, the acryl-based base polymer may contain other monomer components. Examples of the monomer components include:

vinyl-based monomers such as acid anhydride group-containing monomers, caprolactone adducts of acrylic acids, sulfonic acid group-containing monomers, phosphoric acid group-containing monomers, styrene and α -methylstyrene; cyano group-containing acryl-based monomers such as acrylonitrile and methacrylonitrile; epoxy group-containing monomers such as glycidyl (meth)acrylate; glycol-based acryl ester monomers such as polyethylene glycol (meth)acrylate, polypropylene glycol (meth)acrylate, methoxyethylene glycol (meth)acrylate and methoxypolypropylene glycol (meth)acrylate; and acrylic acid ester-based monomers such as tetrahydrofurfuryl (meth)acrylate, fluorine (meth)acrylate, silicone (meth)acrylate and 2-methoxyethyl (meth)acrylate.

[0040] The acryl-based base polymer is obtained by polymerizing the monomer components using various kinds of known methods such as solution polymerization, emulsification polymerization and mass polymerization. The solution polymerization method is suitable from the viewpoint of a balance of properties such as adhesive strength and retentive strength of the pressure sensitive adhesive, costs and so on. As a solvent for solution polymerization, ethyl acetate, toluene or the like is generally used. The solution concentration is normally about 20 to 80% by weight. As the polymerization initiator, an azo-based initiator, a peroxide-based initiator, a redox-based initiator obtained by combining a peroxide and a reducing agent (*e.g.*, combination of a persulfate and sodium hydrogen sulfite, combination of a peroxide and sodium ascorbate, or the like), or the like is preferably used. The usage amount of the polymerization initiator is not particularly limited, and is for example about 0.005 to 5 parts by weight, preferably about 0.02 to 3 part by weight based on 100 parts by weight of the total amount of monomer components that form the base polymer.

[0041] For adjusting the molecular weight of the base polymer, a chain-transfer agent may be used. As the chain-transfer agent, for example, a thiol such as α -thioglycerol, lauryl mercaptan, glycidyl mercaptan, mercaptoacetic acid, 2-mercaptoethanol, thioglycolic acid, 2-ethylhexyl thioglycollate or 2,3-dimercapto-1-propanol is suitably used.

[0042] The viscoelasticity of the pressure sensitive adhesive sheet before photocuring is influenced by the constituent components and the molecular weight of the base polymer.

The weight average molecular weight of the acryl-based base polymer is preferably 100,000 to 2,000,000, more preferably 150,000 to 1,000,000, further preferably 200,000 to 700,000. The molecular weight of the base polymer refers to the molecular weight before introduction of a crosslinked structure.

[0043] <Crosslinked Structure of Base Polymer>

In general, examples of the method for introducing a crosslinked structure into a base polymer include (1) a method in which a base polymer having a functional group capable of reacting with a crosslinker is prepared, and the crosslinker is then added to
5 react the base polymer with the crosslinker; and (2) a method in which a photopolymerizable polyfunctional compound is incorporated in polymerization components of a base polymer to introduce a branched structure (crosslinked structure) into the polymer chain.

[0044] The pressure sensitive adhesive sheet of the present invention includes a base
10 polymer having a crosslinked structure introduced by the method (1) above. Further, the pressure sensitive adhesive composition that forms the pressure sensitive adhesive sheet contains a photopolymerizable polyfunctional compound, and the crosslinked structure in the method (2) is introduced by performing photocuring after the pressure sensitive adhesive sheet is bonded to an adherend. That is, in the pressure sensitive adhesive sheet
15 of the present invention, the base polymer has a crosslinked structure with a (thermal) crosslinker such as an isocyanate crosslinker. In the photocured pressure sensitive adhesive sheet, not only the crosslinked structure with an isocyanate crosslinker or the like but also a crosslinked structure with a photopolymerizable polyfunctional compound (photocrosslinker) such as polyfunctional (meth)acrylate is introduced into the base
20 polymer.

[0045] <Crosslinker>

After polymerization of the base polymer, a crosslinker is added, and the mixture is optionally heated to introduce a crosslinked structure into the base polymer. Although crosslinking with an isocyanate crosslinker or the like may be described as “thermal
25 crosslinking” for discriminating the crosslinking from a crosslinking structure introduced by a photopolymerizable polyfunctional compound, the crosslinked structure by a crosslinker may be introduced without heating. By introducing a thermal-crosslinked structure into the acryl-based base polymer, the processability and processing dimensional stability of the pressure sensitive adhesive sheet before photocuring can be improved.

[0046] Examples of the crosslinker include compounds that react with functional groups
30 such as a hydroxy group and a carboxy group contained in the base polymer. Specific examples of the crosslinker include isocyanate-based crosslinkers, epoxy-based crosslinkers, oxazoline-based crosslinkers, aziridine-based crosslinkers, carbodiimide-

based crosslinkers and metal chelate-based crosslinkers.

[0047] In particular, isocyanate-based crosslinkers and epoxy-based crosslinkers are preferable because they have high reactivity with the hydroxy group and the carboxy group of the base polymer, so that introduction of a crosslinked structure is facilitated.

5 Such a crosslinker forms a crosslinked structure by reacting with functional groups such as a hydroxy group and a carboxy group which are introduced into the base polymer. In an acid-free pressure sensitive adhesive in which the base polymer does not contain a carboxy group, it is preferable to form a crosslinked structure by use of an isocyanate-based crosslinker, *i.e.*, by reaction of a hydroxy group in the base polymer with the
10 isocyanate crosslinker.

[0048] As an isocyanate-based crosslinker, a polyisocyanate having two or more isocyanate groups per molecule is used. Examples of the polyisocyanate-based crosslinker include lower aliphatic polyisocyanates such as butylene diisocyanate and hexamethylene diisocyanate; cycloaliphatic isocyanates such as cyclopentylene diisocyanate, cyclohexylene
15 diisocyanate and isophorone diisocyanate; aromatic isocyanates such as 2,4-tolylene diisocyanate, 4,4'-diphenylmethane diisocyanate and xylylene diisocyanate; isocyanate adducts such as trimethylolpropane/tolylene diisocyanate trimer adducts (*e.g.* "CORONATE L" manufactured by Tosoh Corporation), trimethylolpropane/hexamethylene diisocyanate trimer adducts (*e.g.* "CORONATE HL"
20 manufactured by Tosoh Corporation), trimethylolpropane adducts of xylylene diisocyanate (*e.g.* "TAKENATE D110N" manufactured by Mitsui Chemicals, Incorporated) and isocyanurate forms of hexamethylene diisocyanate (*e.g.* "CORONATE HX" manufactured by Tosoh Corporation).

[0049] The gel fraction of the pressure sensitive adhesive sheet can be adjusted within a
25 desired range by adjusting the amount of the crosslinker. The amount of the crosslinker is preferably 0.01 to 1 parts by weight, more preferably 0.03 to 0.8 parts by weight, further preferably 0.05 to 0.5 parts by weight, especially preferably 0.08 to 0.3 parts by weight based on 100 parts by weight of the base polymer. The gel fraction of the pressure sensitive adhesive sheet before photocuring tends to increase, as the amount of the
30 crosslinker increases.

[0050] <Photopolymerizable Polyfunctional Compound>

The photopolymerizable polyfunctional compound contained in the pressure sensitive adhesive sheet has two or more photopolymerizable functional groups per

molecule. The photopolymerizable functional group may be any of radically polymerizable, cationically polymerizable and anionically polymerizable photopolymerizable functional groups, but a radical-polymerizable functional group having an unsaturated double bond (ethylenically unsaturated group) is preferable because it is excellent in reactivity. The photopolymerizable polyfunctional compound is preferably a polyfunctional (meth) acrylate because it has high compatibility with the acryl-based base polymer, and is especially preferably a polyfunctional acrylate because it has high photoradical reactivity.

[0051] Examples of the polyfunctional (meth)acrylate include difunctional (meth)acrylic acid esters such as hexanediol di(meth)acrylate, nonanediol di(meth)acrylate, polyethylene glycol di(meth)acrylate, polypropylene glycol di(meth)acrylate, polytetramethylene glycol di(meth)acrylate, bisphenol A ethylene oxide-modified di(meth)acrylate, bisphenol A propylene oxide-modified di(meth)acrylate, alkanediol di(meth)acrylate, tricyclodecane dimethanol di(meth)acrylate, pentaerythritol di(meth)acrylate, neopentyl glycol di(meth)acrylate and glycerin di(meth)acrylate; trifunctional (meth)acrylic acid esters such as pentaerythritol tri(meth)acrylate, trimethylolpropane tri(meth)acrylate and ethoxylated isocyanuric acid tri(meth)acrylate; tetrafunctional (meth)acrylic acid esters such as ditrimethylolpropane tetra(meth)acrylate, ethoxylated pentaerythritol tetra(meth)acrylate and pentaerythritol tetra(meth)acrylate; and penta-or-more-functional (meth)acrylic acid esters such as dipentaerythritol penta(meth)acrylate etc. and dipentaerythritol hexa(meth)acrylate etc.

[0052] The content of the photopolymerizable polyfunctional compound initiator in the photocurable pressure sensitive adhesive layer is preferably 0.3 to 10 parts by weight, more preferably 0.5 to 5 parts by weight based on 100 parts by weight of the base polymer. As the amount of the polyfunctional compound increases, the gel fraction of the pressure sensitive adhesive after photocuring tends to increase, leading to improvement of bonding reliability. On the other hand, when the content of the polyfunctional compound is excessively high, the pressure sensitive adhesive may be excessively hard, leading to deterioration of impact resistance and the adhesion retaining force at a low temperature. The amount of the photopolymerizable polyfunctional compound may be 0.7 parts by weight or more, or 1 part by weight or more, based on 100 parts by weight of the base polymer. The amount of the photopolymerizable polyfunctional compound may be 4 parts by weight or less, or 3 parts weight or less, based on 100 parts by weight of the base polymer.

[0053] <Photopolymerization Initiator>

The photocurable pressure sensitive adhesive composition contains a photopolymerization initiator. The photopolymerization initiator can generate radicals, acids, bases or the like when irradiated with an active ray such as an ultraviolet ray. The photopolymerization initiator can be appropriately selected according to the type of a photopolymerizable compound. When a polyfunctional (meth)acrylate is used as the photopolymerizable compound, it is preferable to use a photoradical polymerization initiator as the photopolymerization initiator.

[0054] The photoradical initiator is preferably one having a sensitivity to an ultraviolet ray having a wavelength shorter than 405 nm, and examples thereof include hydroxy ketones, benzyl dimethyl ketals, aminoketones, acylphosphine oxides, and benzophenones, trichloromethyl group-containing triazine derivatives. A photoradical generator may be used alone, or two or more photoradical generators may be used in combination.

[0055] It is preferable that the photopolymerization initiator has low sensitivity to light having a wavelength longer than 400 nm (visible light). The absorption coefficient ϵ of the photopolymerization initiator at a wavelength of 405 nm is preferably 50 [mLg⁻¹cm⁻¹] or less, more preferably 20 [mLg⁻¹cm⁻¹] or less, further preferably 10 [mLg⁻¹cm⁻¹] or less. By using a photopolymerization initiator having low light absorption at a wavelength of 405 nm, the transparency of the pressure sensitive adhesive sheet can be improved. In addition, when a photopolymerization initiator having low sensitivity to visible light is used, photopolymerization of the pressure sensitive adhesive which is caused by external light in a storage environment hardly progresses, so that the storage stability of the pressure sensitive adhesive sheet can be improved. The light absorption coefficient of the photopolymerization initiator is a value calculated from the absorbance of a 0.001g/mL acetonitrile solution which is measured by an UV-visible spectrophotometer using a quartz cell having an optical path length of 1 cm.

[0056] From the viewpoint of improving the storage stability of the pressure sensitive adhesive sheet, it is preferable to use a photoradical polymerization initiator having no absorption maximum at a wavelength longer than 380 nm. A photoradical polymerization initiator having an absorption maximum at a wavelength longer than 380 nm easily absorbs light from a fluorescent lamp (mainly a 405 nm-mercury emission line) to generate photoradicals. When the maximum wavelength in absorption of light by the photoradical polymerization initiator is 370 nm or less, the amount of radicals generated

by light from a fluorescent lamp or the like in a storage environment is small. Thus, even when the pressure sensitive adhesive sheet is stored for a long time under a fluorescent lamp, the effective concentration of the photoradical polymerization initiator can be kept high.

5 [0057] For ensuring that storage stability is high, and bonding reliability with an adherend can be improved by photoirradiation even after long-term storage, it is preferable that the photopolymerization initiator contained in the pressure sensitive adhesive sheet has a light absorption maximum at a wavelength of 370 nm or less. On the other hand, for enhancing the photocuring efficiency by irradiation with an ultraviolet ray,
10 it is preferable that the photopolymerization initiator has a light absorption maximum at a wavelength longer than 310 nm. Thus, for attaining both the transparency and the storage stability of the pressure sensitive adhesive sheet, the photopolymerization initiator contained in the pressure sensitive adhesive sheet is preferably one having no absorption maximum at a wavelength longer than 380 nm and having an absorption maximum in
15 the wavelength range of 310 to 370 nm. The photopolymerization initiator is more preferably one having an absorption maximum in the wavelength range of 310 to 355 nm. The wavelength at which the photopolymerization initiator has an absorption maximum is further preferably 315 to 350 nm, especially preferably from 320 to 345 nm.

[0058] Preferably, the photopolymerization initiator has a sensitivity to light having a
20 wavelength of 380 nm. The photopolymerization initiator has a sensitivity to light having a wavelength of 380 nm, and therefore even when the pressure sensitive adhesive sheet contains an ultraviolet absorber, photocuring can be appropriately performed because the photopolymerization initiator can absorb light which is not absorbed by the ultraviolet absorber. The absorption coefficient ε of the photopolymerization initiator at a wavelength
25 of 380 nm is preferably 80 [mLg⁻¹cm⁻¹] or more, more preferably 100 [mLg⁻¹cm⁻¹] or more, further preferably 120 [mLg⁻¹cm⁻¹] or more. The light absorption coefficient of the photopolymerization initiator at a wavelength of 380 nm is generally 1000 [mLg⁻¹cm⁻¹] or less, and may be 500 [mLg⁻¹cm⁻¹] or less, or 300 [mLg⁻¹cm⁻¹] or less.

[0059] The content of the photopolymerization initiator in the pressure sensitive
30 adhesive sheet may be set according to the absorbance or the like. The product εw of the light absorption coefficient ε (mLg⁻¹cm⁻¹) of the photopolymerization initiator at a wavelength of 380 nm and the content w (parts by weight) of the photopolymerization initiator based on 100 parts by weight of the base polymer is preferably 10 to 100, more

preferably 15 to 80. When the value εw increases, photocuring easily progresses, but on the other hand, photocuring by light from a fluorescent lamp in a storage environment easily progresses.

[0060] When the value εw is within the above range, sufficient optical reactivity is exhibited in application of light while photocuring of the pressure sensitive adhesive in a storage environment is suppressed. The product εw of the light absorption coefficient ε and the content w of the photopolymerization initiator may be 20 or more, 25 or more, or 30 or more. The value εw may be 60 or less, or 50 or less. The content w of the photopolymerization initiator based on 100 parts by weight of the base polymer is, for example, 0.05 to 1 part by weight, preferably 0.08 to 0.5 part by weight.

[0061] <Ultraviolet Absorber>

The ultraviolet absorber has a suppressive action on a photocuring reaction of the pressure sensitive adhesive sheet in a storage environment. In a composition containing an ultraviolet inhibitor in addition to the photopolymerization initiator, the amount of light absorbed by the photopolymerization initiator is relatively small because the amount of light absorbed by the ultraviolet absorber is large even when light having a wavelength at which the photopolymerization initiator has a sensitivity is applied from a fluorescent lamp or the like. Thus, photocuring (polymerization reaction of the photopolymerizable polyfunctional compound) of the pressure sensitive adhesive sheet by light from a fluorescent lamp or the like in a storage environment is suppressed.

[0062] Examples of the ultraviolet absorber include benzotriazole-based ultraviolet absorbers, benzophenone-based ultraviolet absorbers, salicylate-based ultraviolet absorbers, triazine ultraviolet absorbers and cyanoacrylate-based ultraviolet absorbers. Triazine-based ultraviolet absorbers and benzotriazole-based ultraviolet absorbers are preferable because they have high ultraviolet absorbability at a wavelength range of 320 to 370 nm and have excellent compatibility with acryl-based polymers. Among them, triazine-based ultraviolet absorbers containing a hydroxyl group (in particular, hydroxyphenyl triazine-based ultraviolet absorbers), and benzotriazole-based ultraviolet absorbers containing one benzotriazole backbone per molecule are preferable.

[0063] As the ultraviolet absorber, a commercially available product may be used. Examples of the commercially available triazine-based ultraviolet absorber include reaction products of 2-(4,6-bis (2,4-dimethylphenyl)-1,3,5-triazin-2-yl)-5-hydroxyphenyl with [(alkyloxy)methyl]oxirane ("TINUVIN 400" manufactured by BASF SE), reaction

products of 2-(2,4-dihydroxyphenyl)-4,6-bis-(2,4-dimethylphenyl)-1,3,5-triazine with (2-ethylhexyl)-glycidic acid ester ("TINUVIN 405" manufactured by BASF SE), (2,4-bis[2-hydroxy-4-butoxyphenyl]-6-(2,4-dibutoxyphenyl)-1,3,5-triazine ("TINUVIN 460" manufactured by BASF SE), 2-(4,6-diphenyl-1,3,5-triazin-2-yl)-5-[(hexyl)oxy]-phenol ("TINUVIN 577" manufactured by BASF SE), 2-(2-hydroxy-4-[1-octyloxycarbonylethoxy]phenyl)-4,6-bis(4-phenylphenyl)-1,3,5-triazine ("TINUVIN 479" manufactured by BASF SE), bis(ethylhexyl) oxyphenolmethoxyphenyl triazine ("Tinosorb S" manufactured by BASF SE), and 2-(4,6-diphenyl-1,3,5-triazine-2-yl)-5-[2-(2-ethylhexanoyloxy)ethoxy]-phenol ("ADK STAB LA-46" manufactured by ADEKA Corporation).

[0064] Examples of the commercially available benzotriazole ultraviolet absorber include 2-(2H-benzotriazol-2-yl)-6-(1-methyl-1-phenylethyl)-4-(1,1,3,3-tetramethylbutyl)phenol ("TINUVIN 928" manufactured by BASF SE), 2-(2-hydroxy-5-tert-butylphenyl)-2H-benzotriazole ("TINUVIN PS" manufactured by BASF SE), 2-(2H-benzotriazol-2-yl)-4,6-bis(1-methyl-1-phenylethyl)phenol ("TINUVIN 900" manufactured by BASF SE), 2-(2H-benzotriazol-2-yl)-6-(1-methyl-1-phenylethyl)-4-(1,1,3,3-tetramethylbutyl)phenol ("TINUVIN 928" manufactured by BASF SE), 2-(2H-benzotriazol-2-yl)-6-dodecyl-4-methylphenol ("TINUVIN 571" manufactured by BASF SE), 2-(2H-benzotriazol-2-yl)-p-cresol ("TINUVIN P" manufactured by BASF SE), 2-(2H-benzotriazol-2-yl)-4-6-bis(1-methyl-1-phenylethyl)phenol ("TINUVIN 234" manufactured by BASF SE), 2-(5-chloro(2H)-benzotriazol-2-yl)-4-methyl-6-(tert-butyl)phenol ("TINUVIN 326" manufactured by BASF SE), 2-(2H-benzotriazol-2-yl)-4,6-di-tert-pentylphenol ("TINUVIN 328" manufactured by BASF SE), 2-(2H-benzotriazol-2-yl)-4-(1,1,3,3-tetramethylbutyl)phenol ("TINUVIN 329" manufactured by BASF SE), ester compounds of benzenepropanoic acid with 3-(2H-benzotriazol-2-yl)-5-(1,1-dimethylethyl)-4-hydroxy (C7-9 side chain and linear alkyl) ("TINUVIN 384-2" manufactured by BASF SE), reaction products of methyl-3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl)propionate with polyethylene glycol ("TINUVIN 130" manufactured by BASF SE), reaction products of methyl 3-(3-(2H-benzotriazol-2-yl)-5-tert-butyl-4-hydroxyphenyl) propionate with polyethylene glycol 300 ("TINUVIN 213" manufactured by BASF SE), and 2-[2-hydroxy-3-(3,4,5,6-tetrahydrophthalimido-methyl)-5-methylphenyl]benzotriazole ("Sumisorb 250" manufactured by Sumitomo Chemical Company, Limited).

[0065] The content of the ultraviolet absorber in the pressure sensitive adhesive sheet is,

for example, about 0.05 to 3 parts by weight, preferably about 0.1 to 1 parts by weight, based on 100 parts by weight of the base polymer. Photocuring of the pressure sensitive adhesive sheet by light from a fluorescent lamp or the like in a storage environment tends to be suppressed when the amount of the ultraviolet absorber increases. On the other hand, when the amount of the ultraviolet absorber is excessively large, even application of excitation light (ultraviolet ray) for photocuring may fail to achieve sufficient curing because a large amount of the excitation light is absorbed by the ultraviolet absorber, leading to a decrease in the amount of light absorbed by the photopolymerization initiator.

[0066] (Oligomer)

The pressure sensitive adhesive composition may contain oligomers for the purpose of, for example, adjusting the adhesive strength and the viscosity of the pressure sensitive adhesive sheet. As the oligomer, one having a weight average molecular weight of, for example, about 1000 to 30000 is used. The oligomer is preferably an acryl-based oligomer because it is excellent in compatibility with the acryl-based base polymer.

[0067] (silane coupling agent)

A silane coupling agent can also be added in the pressure sensitive adhesive composition for the purpose of adjusting the adhesive strength. When the pressure sensitive adhesive composition includes a silane coupling agent, the content thereof is normally about 0.01 to 5.0 parts by weight, preferably 0.03 to 2.0 parts by weight based on 100 parts by weight of the base polymer.

[0068] (Other additives)

In addition to the components exemplified above, additives such as a tackifier, a plasticizer, a softener, a degradation inhibitor, a filler, a colorant, an antioxidant, a surfactant and an antistatic agent maybe contained in the pressure sensitive adhesive composition.

[0069] [Preparation of Pressure Sensitive Adhesive Sheet]

A pressure sensitive adhesive composition is prepared by mixing a crosslinker, a photopolymerizable polyfunctional compound, a photopolymerization initiator, an ultraviolet absorber, and optionally an oligomer, a silane coupling agent, various additives and the like with the base polymer. Preferably, the pressure sensitive adhesive composition has a viscosity (*e.g.*, about 0.5 to 20 Pa·s) suitable for application of the composition onto a substrate. The viscosity of the pressure sensitive adhesive composition can be set within an appropriate range by adjusting the molecular weight of the base

polymer, the amount of the photopolymerizable polyfunctional compound, and composition, molecular weight and amount of other components (*e.g.*, oligomer), and so on. Additives such as thickener may be used for the purpose of, for example, adjusting the viscosity.

[0070] A pressure sensitive adhesive composition is applied onto a substrate, and a solvent is optionally removed by drying to form a pressure sensitive adhesive sheet on the substrate. For the substrate to be used for formation of the pressure sensitive adhesive sheet, any suitable material is used. The substrate may be a release film having a release layer on a contact surface with the pressure sensitive adhesive sheet.

[0071] As the base film of the release film, films composed of various resin materials are used. Examples of the resin material include polyester-based resins such as polyethylene terephthalate and polyethylene naphthalate, acetate-based resins, polyether sulfone-based resins, polycarbonate-based resins, polyamide-based resins, polyimide-based resins, polyolefin-based resins, (meth)acryl-based resins, polyvinyl chloride-based resins, polyvinylidene chloride-based resins, polystyrene-based resins, polyvinyl alcohol-based resins, polyacrylate-based resins and polyphenylene sulfide-based resins. Among them, polyester-based resins such as polyethylene terephthalate are especially preferable. The thickness of the base film is preferably 10 to 200 μm , more preferably 25 to 150 μm . Examples of the material of the release layer include silicone-based release agents, fluorine-based release agents, long-chain alkyl-based release agents and aliphatic amide-based release agents. The thickness of the release layer is generally about 10 to 2000 nm.

[0072] For applying the pressure sensitive adhesive composition on the substrate, various kinds of coating methods such as roll coating, kiss roll coating, gravure coating, reverse coating, roll brushing, spray coating, dip roll coating, bar coating, knife coating, air knife coating, curtain coating, lip coating, and extrusion coating may be employed.

[0073] When the pressure sensitive adhesive composition includes a solvent, the solvent is preferably dried after application of the pressure sensitive adhesive composition on the substrate. As a method for drying, a suitable method can be appropriately employed according to a purpose. The heating/drying temperature is preferably 40°C to 200°C, more preferably 50°C to 180°C, further preferably 70°C to 170°C. Drying time can be appropriately set. The drying time is preferably 5 seconds to 20 minutes, more preferably 5 seconds to 15 minutes, further preferably 10 seconds to 10 minutes.

[0074] After the solvent is removed by drying, it is preferable to dispose a cover sheet for protecting the surface of the pressure sensitive adhesive sheet. Preferably, a release film

having a release layer on the contact surface with the pressure sensitive adhesive sheet, like the base film, is used as the cover sheet.

[0075] After the pressure sensitive adhesive composition is applied onto the substrate, heating is optionally performed to introduce a crosslinked structure into the base polymer.

5 The heating temperature and the heating time may be appropriately set according to the type of crosslinker to be used, and normally, the heating is performed at 20°C to 160°C for about 1 minute to 7 days. The heating for removing the solvent by drying may also serve as heating for crosslinking. As described above, the introduction of the crosslinked structure does not necessarily require heating.

10 **[0076]** A crosslinking catalyst may be used for accelerating formation of a crosslinked structure. Examples of the crosslinking catalyst of the isocyanate-based crosslinker include metal-based crosslinking catalysts (particularly tin-based crosslinking catalysts) such as tetra-n-butyl titanate, tetraisopropyl titanate, NACEM ferric, butyl tin oxide, dioctyl tin dilaurate and dibutyl tin dilaurate.

15 **[0077]** Release films 1 and 2 are bonded, respectively, to surfaces of the pressure sensitive adhesive sheet 5 to obtain a pressure sensitive adhesive sheet in which a release film is temporarily attached to each of both surfaces as shown in FIG. 1. The substrate and the cover sheet used for formation of the pressure sensitive adhesive sheet may be remain attached to the pressure sensitive adhesive to be used as release films 1 and 2.

20 **[0078]** When release films 1 and 2 are disposed on both surfaces of the pressure sensitive adhesive sheet 5, the thickness of one release film 1 and the thickness of the other release film 2 may be the same, or different. The peeling strength in peeling of the release film temporarily attached to one surface from the pressure sensitive adhesive sheet 5 and the peeling strength in peeling of the release film temporarily attached to the other surface
25 from the pressure sensitive adhesive sheet 5 may be the same or different. When the peeling strength of the release film on one surface is different from the peeling strength of the release film on the other surface, excellent workability can be attained by performing the bonding of adherends in the following procedure: the release film 2 with relatively small peeling strength (lightly peelable film) is first peeled from the pressure sensitive
30 adhesive sheet 5, and bonded to a first adherend, and the release film 1 with relatively large peeling strength (heavily peelable film) is peeled, and bonded to a second adherend.

[0079] [Physical Properties of Pressure Sensitive Adhesive Sheet]

Introduction of a crosslinked structure into the base polymer by an isocyanate-

based crosslinker or the like increases the gel fraction. The gel fraction of the pressure sensitive adhesive sheet before photocuring is preferably 30 to 80%. When the gel fraction is 80% or less, the pressure sensitive adhesive easily follows a printing level difference of a cover window or the like, so that generation of voids in the vicinity of the level difference can be suppressed. When the gel fraction is 30% or more, the pressure sensitive adhesive sheet has excellent handleability and processability. The gel fraction of the pressure sensitive adhesive sheet before photocuring is more preferably from 35 to 70%, further preferably from 40 to 65%.

[0080] The gel fraction of the pressure sensitive adhesive sheet can be determined as a content of components insoluble in a solvent such as ethyl acetate, and specifically, the gel fraction is determined as a weight fraction (unit: % by weight) of insoluble components after immersion of the pressure sensitive adhesive layer in ethyl acetate at 23°C for 7 days to the sample before immersion. Generally, the gel fraction of the polymer is equal to a crosslinking degree, and the gel fraction becomes higher as the number of crosslinked moieties in the polymer increases. The gel fraction (introduction amount of crosslinked structure) can be adjusted within a desired range by a method for introducing a crosslinked structure, the type and the amount of a crosslinker, and the like.

[0081] When photocuring is performed by irradiating the photocurable pressure sensitive adhesive sheet with an active ray such as an ultraviolet ray, the photocurable polyfunctional compound is photopolymerized to enhance the gel fraction of the pressure sensitive adhesive sheet. The gel fraction of the pressure sensitive adhesive sheet after the pressure sensitive adhesive sheet is photocured by application of an ultraviolet ray at 1000 mJ/cm² is preferably 40% or more, more preferably 50% or more. The gel fraction of the pressure sensitive adhesive sheet after photocuring may be 55% or more, or 60% or more. The gel fraction of the pressure sensitive adhesive sheet after photocuring may be 100% or less, 95% or less, or 90% or less.

[0082] The gel fraction of the pressure sensitive adhesive sheet after the pressure sensitive adhesive sheet is photocured by application of an ultraviolet ray at 1000 mJ/cm² is preferably higher by 5% or more than the gel fraction of the pressure sensitive adhesive sheet before the photocuring. When the gel fraction is increased by 5% or more, adhesive reliability tends to be enhanced.

[0083] When the pressure sensitive adhesive sheet is left standing under a fluorescent lamp for 7 days, and then photocured by applying an ultraviolet ray at 1000 mJ/cm², the

gel fraction after the photocuring is preferably larger by 5% or more than the gel fraction of the pressure sensitive adhesive sheet after the pressure sensitive adhesive sheet is left standing under a fluorescent lamp and before the pressure sensitive adhesive sheet is photocured. As described later, by appropriately selecting and adjusting the types and amounts of the photopolymerization initiator and the ultraviolet absorber, the difference in gel fraction before and after photocuring can be set to 5% or more because photocuring under a fluorescent lamp hardly progresses and photocuring appropriately progresses at the time of applying excitation light (ultraviolet ray) for curing.

[0084] Since the pressure sensitive adhesive sheet of the present invention contains a photopolymerization initiator and an ultraviolet absorber, the pressure sensitive adhesive sheet is hardly photocured by light from a fluorescent lamp or the like in a storage environment. The intensity of light such as light from a fluorescent lamp in a storage environment is sufficiently smaller than the intensity of excitation light in photocuring of the pressure sensitive adhesive sheet, and therefore even when the pressure sensitive adhesive sheet is left standing under a fluorescent lamp for a short time. However, when the pressure sensitive adhesive sheet is stored under a fluorescent lamp for a long period of time, the cumulative amount of photoexcitation components (*e.g.*, photoradicals) generated from the photopolymerization initiator which has absorbed light from the fluorescent lamp may increase to the extent that the effect thereof is not negligible. Specifically, level difference followability may be deteriorated because photoradicals generated from the photopolymerization initiator causes progression of photopolymerization of the photopolymerizable polyfunctional compound, and thus the gel fraction of the pressure sensitive adhesive increases, so that the pressure sensitive adhesive is hardened.

[0085] In the pressure sensitive adhesive sheet of the present invention, the photocurable pressure sensitive adhesive composition which forms the pressure sensitive adhesive sheet contains an ultraviolet absorber in addition to a base polymer, a photocuring agent and a photopolymerization initiator. The ultraviolet absorber absorbs light (ultraviolet ray) having a wavelength in a range which overlaps the absorption band (excitation wavelength) of the photopolymerization initiator. Adjustment of the type and/or amount of the ultraviolet absorber according to the type (light absorption property) of the photopolymerization initiator enables suppression of photocuring of the pressure sensitive adhesive sheet by light from a fluorescent lamp or the like, while maintaining the light

transmittance in a range of wavelengths at which the photopolymerization initiator has a sensitivity.

[0086] A general fluorescent lamp emits a mercury emission line having a wavelength of 365 nm, and therefore by adding an ultraviolet absorber to reduce the light transmittance of the pressure sensitive adhesive sheet at a wavelength of 365 nm, photocuring of the pressure sensitive adhesive sheet in a storage environment can be suppressed even when the pressure sensitive adhesive sheet is stored under a fluorescent lamp for a long period of time. From the viewpoint of suppressing photocuring of the pressure sensitive adhesive sheet in a storage environment, the light transmittance at a wavelength of 365 nm is preferably 1% or less, more preferably 0.5% or less, further preferably 0.3% or less. The light transmittance of the pressure sensitive adhesive sheet at a wavelength of 365 nm may be 0.2% or less, or 0.1% or less.

[0087] From the viewpoint of enhancing visible light transparency, the light transmittance of the pressure sensitive adhesive sheet at a wavelength of 420 nm is preferably 85% or more, more preferably 88% or more. The light transmittance of the pressure sensitive adhesive sheet at a wavelength of 405 nm is preferably 80% or more, more preferably 83% or more. As described above, the photopolymerization initiator has a low optical sensitivity (or no optical sensitivity) at a wavelength of 405 nm, and therefore even when the pressure sensitive adhesive sheet has a high light transmittance at a wavelength of 405 nm, the pressure sensitive adhesive sheet is hardly photocured by light such as external light or light from a fluorescent lamp in a storage environment.

[0088] As described above, the pressure sensitive adhesive sheet has a low transmittance at a wavelength of 365 nm, and most of light having wavelengths in the vicinity of 365 nm is absorbed by the ultraviolet absorber. The photopolymerization initiator has a low optical sensitivity (or no optical sensitivity) at a wavelength of 405 nm. Thus, even when the pressure sensitive adhesive sheet is irradiated with light having a wavelength of 365 nm and/or light having a wavelength of 405 nm, the photopolymerization initiator can utilize a slight amount of light, so that photocuring hardly progresses.

[0089] When the light transmittance of the pressure sensitive adhesive sheet is adjusted so that the photopolymerization initiator can efficiently absorb light having a wavelength in a range above 365 nm and below 405 nm, it is possible to ensure that photocuring in a storage environment hardly progresses, and photocuring appropriately progresses at the time of applying excitation light. Specifically, it is preferable that the photopolymerization

initiator contained in the pressure sensitive adhesive sheet can efficiently utilize light having wavelengths in the vicinity of 380 nm. Thus, the light transmittance of the pressure sensitive adhesive sheet at a wavelength of 380 nm is preferably 4% or more, more preferably 5% or more.

5 [0090] Curing efficiency at the time of irradiating the pressure sensitive adhesive sheet with excitation light to perform photocuring tends to be enhanced as the light transmittance at a wavelength of 380 nm increases. On the other hand, when the light transmittance at a wavelength of 380 nm is excessively large, external light in a storage environment may cause progression of photocuring of the pressure sensitive adhesive
10 sheet, leading to deterioration of level difference followability. In addition, when ultraviolet absorbability is imparted by adding an ultraviolet absorber, the light transmittance at a wavelength of 365 nm tends to increase as the light transmittance at a wavelength of 380 nm increases, it may be impossible to sufficiently suppress photocuring of the pressure sensitive adhesive sheet which is caused by light from a fluorescent lamp
15 or the like in a storage environment. Thus, the light transmittance of the pressure sensitive adhesive sheet at a wavelength of 380 nm is preferably 25% or less, more preferably 20% or less.

[0091] The wavelength at which the transmittance is 10% or more when the light transmission spectrum of the pressure sensitive adhesive sheet is viewed in a direction
20 from the short wavelength side toward the long wavelength side (hereinafter, sometimes referred to as a “10% cut-on wavelength”) is preferably within the range of 370 nm to 385 nm. The 10% cut-on wavelength is shifted toward the short wavelength side when the amount of the ultraviolet absorber is increased, and the 10% cut-on wavelength is shifted toward the long wavelength side when the amount of the ultraviolet absorber is decreased.

25 [0092] From the viewpoint of suppressing photocuring of the pressure sensitive adhesive sheet in a storage environment, and increasing photocuring efficiency at the time of application of excitation light, it is preferable that the ultraviolet absorber is added to adjust the light absorption property of the pressure sensitive adhesive sheet as described above, and the amount of the photopolymerization initiator is adjusted according to the
30 light transmittance of the pressure sensitive adhesive sheet. Consideration of a light transmittance T (%) of the pressure sensitive adhesive sheet at a wavelength of 380 nm indicates that when the light transmittance T is high, even a small amount of the photopolymerization initiator enables attainment of photocuring efficiency during

application of excitation light because the photopolymerization initiator can absorb a large amount of light. On the other hand, when the light transmittance T is low, photocuring by light from a fluorescent lamp or the like in a storage environment hardly occurs even when the amount of the photopolymerization initiator increases.

5 [0093] Therefore, it is preferable that the amount of the photopolymerization initiator is relatively large when the light transmittance T of the pressure sensitive adhesive sheet at a wavelength of 380 nm is low, and it is preferable that the amount of the photopolymerization initiator is relatively small when the light transmittance T is high. As described above, the effective amount of the photopolymerization initiator in the
10 pressure sensitive adhesive sheet can be evaluated by the product ϵw of the content and the light absorption coefficient ϵ of the photopolymerization initiator.

[0094] From the viewpoint of suppressing photocuring of the pressure sensitive adhesive sheet in a storage environment, and enhancing photocuring efficiency at the time of application of excitation light, the product ϵwT of the light transmittance T (%) of the
15 pressure sensitive adhesive sheet at a wavelength of 380 nm, the content w (parts by weight) of the photopolymerization initiator based on 100 parts by weight of the base polymer and the light absorption coefficient ϵ ($\text{mLg}^{-1}\text{cm}^{-1}$) of the photopolymerization initiator at a wavelength of 380 nm is preferably within a predetermined range.

[0095] The value ϵwT of the pressure sensitive adhesive sheet is preferably 100 to 1200,
20 more preferably 110 to 1000. The value ϵwT may be 120 or more, 130 or more, 140 or more, or 150 or more. The value ϵwT may be 700 or less, 600 or less, or 500 or less. Photocuring efficiency at the time of application of excitation light tends to be enhanced when the value ϵwT increases, and photocuring of the pressure sensitive adhesive sheet in a storage environment tends to be suppressed when the value ϵwT decreases.

25 [0096] [Image Display Device]

The pressure sensitive adhesive sheet of the present invention can be used for bonding various transparent members and opaque members. The type of the adherend is not particularly limited, and examples thereof include various resin materials, glass and metals. The pressure sensitive adhesive sheet of the present invention has high
30 transparency, and is therefore suitable for bonding optical members of an image display device etc. In particular, the pressure sensitive adhesive sheet of the present invention can impart level difference absorbency and impact resistance, and is therefore suitably used for bonding a transparent member such as a front transparent plate or a touch panel

onto a viewing-side surface of an image display device.

[0097] FIG. 2 is a sectional view showing an example of a stacking configuration of an image display device in which the front transparent plate 7 is bonded to a viewing-side surface of an image display panel 10 with the pressure sensitive adhesive sheet 5 interposed therebetween. The image display panel 10 includes an image display cell 6 such as a liquid crystal cell or an organic EL cell, and a polarizing plate 3 bonded to the viewing-side surface of the image display cell 6 with a pressure sensitive adhesive sheet 4 interposed therebetween. The front transparent plate 7 includes a transparent flat plate 71 and a printed layer 76 disposed on the peripheral edge of one principal surface of the transparent flat plate 71. As the transparent plate 71, for example, a transparent resin plate such as that of an acryl-based resin or a polycarbonate-based resin, or a glass plate is used. The transparent plate 71 may have a touch panel function. As the touch panel, a touch panel of any type such as resistive film type, capacitance type, optical type or ultrasonic type is used.

[0098] The polarizing plate 3 disposed on a surface of the image display panel 10 and the printed layer 76-formed surface of the front transparent plate 7 are bonded to each other with the pressure sensitive adhesive sheet 5. The order of bonding is not particularly limited, bonding of the image display panel 10 to the pressure sensitive adhesive sheet 5 may precede, or bonding of the front transparent plate 7 to the pressure sensitive adhesive sheet 5 may precede. The former bonding and the latter bonding may be performed simultaneously. For improving workability in bonding, it is preferred that one release film (lightly peelable film) 2 is first peeled off to expose the first principal surface of the pressure sensitive adhesive sheet followed by bonding the image display panel 10, and then the other release film (heavily peelable film) 1 is peeled off to expose the second principal surface of the pressure sensitive adhesive sheet 5 followed by bonding the front transparent plate 7.

[0099] It is preferred to perform degassing for removing bubbles at the interface between the pressure sensitive adhesive sheet 5 and the flat plate 71 of the front transparent plate 7, and in the vicinity of a non-flat portion such as the printed layer 76 after pressure sensitive adhesive sheet 5 and the front transparent plate 7 are bonded to each other. Since the pressure sensitive adhesive sheet is in a state before photocuring, so that the pressure sensitive adhesive has high fluidity, the pressure sensitive adhesive easily follows the shape of a non-flat portion such as a level difference, and thus bubbles are easily

removed. In addition, even after the pressure sensitive adhesive sheet is stored in an environment, *e.g.*, under a fluorescent lamp, for a long period of time, photocuring of the pressure sensitive adhesive sheet is suppressed, so that level difference followability can be maintained.

5 [0100] As a degassing method, an appropriate method such as heating, pressurization or pressure reduction can be employed. For example, it is preferred that bonding is performed while ingress of bubbles is suppressed under reduced pressure and heating, and pressurization is then performed in parallel with heating through autoclave or the like for the purpose of, for example, suppressing delay bubbles. When degassing is
10 performed by heating, the heating temperature is generally in a range of 40°C to 150°C. When pressurization is performed, the pressure is generally in a range of generally about 0.05 MPa to 2 MPa.

[0101] The pressure sensitive adhesive sheet before photocuring is bonded to an adherend such as a front transparent plate, and the pressure sensitive adhesive
15 composition that forms the pressure sensitive adhesive sheet is then photocured. The light irradiation amount during photocuring is not particularly limited as long as the pressure sensitive adhesive sheet can be photocured, and the light irradiation amount is, for example, about 50 to 10000 mJ/cm² in terms of an accumulated light amount.

[0102] Photoirradiation causes the polymerization reaction of the photopolymerizable
20 polyfunctional compound to proceed, and accordingly, the gel fraction of the pressure sensitive adhesive sheet increases, so that bonding reliability between the pressure sensitive adhesive sheet 5 and the front transparent plate 7 can be enhanced to suppress generation of bubbles at a bonding interface in exposure to a high-temperature environment for a long time. Since the ultraviolet absorbability of the pressure sensitive
25 adhesive sheet, the type and the amount of the photopolymerization initiator, and the like are adjusted as described above, the photocuring reaction efficiency of the pressure sensitive adhesive sheet can be maintained even when the light absorption band of the photopolymerization initiator overlaps the wavelength at which the ultraviolet absorber absorbs light, so that an image display device excellent in bonding reliability of the front
30 transparent member can be formed.

[0103] [Pressure Sensitive Adhesive-equipped Optical Film]

The pressure sensitive adhesive sheet of the present invention can be used not only in a form in which a release film is temporarily attached to each of both surfaces as

shown in FIG. 1, but also as a pressure sensitive adhesive-equipped optical film in which a pressure sensitive adhesive sheet is bonded to an optical film or the like. For example, in the form shown in FIG. 3, the release film 1 is temporarily attached to one surface of the pressure sensitive adhesive sheet 5, and a polarizing plate 3 is bonded to the other surface of the pressure sensitive adhesive sheet 5. In the form shown in FIG. 4, a pressure sensitive adhesive sheet 4 is further provided on the polarizing plate 3, and the release film 2 is temporarily attached on the pressure sensitive adhesive sheet 4.

[0104] In a form in which an optical film such as a polarizing plate is bonded to a pressure sensitive adhesive sheet beforehand as described above, the release film 1 temporarily attached to a surface of the pressure sensitive adhesive sheet 5 may be peeled to bond the pressure sensitive adhesive sheet 5 to a front transparent member, followed by post-curing the pressure sensitive adhesive sheet 5 as necessary.

EXAMPLES

[0105] Further descriptions are made by showing examples, but the present invention is not limited to these examples.

[0106] [Example 1]

(Preparation of Base Polymer)

In a reaction vessel equipped with a thermometer, a stirrer, a cooler and a nitrogen gas introduction pipe, 63 parts by weight of 2-ethylhexyl acrylate, 15 parts by weight of N-vinylpyrrolidone (NVP), 13 parts by weight of hydroxyethyl acrylate and 9 parts by weight of methyl methacrylate as monomer component, and 0.2 parts by weight of azobisisobutyronitrile (AIBN) as a thermopolymerization initiator were added along with 233 parts by weight of ethyl acetate. The mixture was stirred in a nitrogen atmosphere at 23°C for 1 hour, and purged with nitrogen. Thereafter, the mixture was reacted at 65°C for 5 hours, and subsequently reacted at 70°C for 2 hours to prepare a solution of acryl-based base polymer having a weight average molecular weight of 450,000.

[0107] (Preparation of Pressure Sensitive Adhesive Composition)

The followings were added to the obtained acryl-based base polymer solution based on 100 parts by weight of the base polymer, and the mixture was then uniformly mixed to prepare a pressure sensitive adhesive composition: 2 parts by weight of polypropylene glycol (#400) diacrylate ("NK Ester APG-400" manufactured by Shin-Nakamura Chemical Co., Ltd.) as a polyfunctional monomer; 0.16 parts by weight of a

trimethylolpropane adduct of xylylene diisocyanate (“TAKENATE D110N” manufactured by Mitsui Chemicals, Inc.) as an isocyanate-based crosslinker; 0.3 parts by weight of a silane coupling agent (“KBM-403” manufactured by Shin-Etsu Chemical Co., Ltd.); 0.2 parts by weight of 2,2-dimethoxy-1,2-diphenylethan-1-one (“IRGACURE 651”
5 manufactured by BASF SE; absorption maximum wavelengths: 250 nm and 340 nm; light absorption coefficient ϵ at a wavelength of 380 nm: 1.7×10^2 [mLg⁻¹cm⁻¹]) as a photopolymerization initiator; and 0.7 parts by weight of bis-ethylhexyloxyphenol methoxyphenyl triazine (“TINOSORB S” manufactured by BASF SE) as an ultraviolet absorber.

10 **[0108]** (Preparation of Pressure Sensitive Adhesive Sheet)

The pressure sensitive adhesive composition was applied to a release-treated surface of a 75 μ m-thick release film (a polyester film having a surface subjected to release treatment with silicone), and dried at 100°C for 3 minutes to remove the solvent, a 50 μ m-thick release film was then laminated to the surface of the pressure sensitive adhesive
15 layer, and crosslinking is performed in an atmosphere at 25°C for 3 days to obtain a pressure sensitive adhesive sheet having a thickness of 100 μ m.

[0109] [Examples 2 to 6 and Comparative Examples 1 to 3]

In preparation of the pressure sensitive adhesive composition, the addition amounts of the ultraviolet absorber and the photopolymerization initiator were changed
20 as shown in Table 1. A pressure sensitive adhesive sheet was prepared in the same manner as in Example 1 except for the above.

[0110] [Examples 7 and 8]

In preparation of the pressure sensitive adhesive composition, dipentaerythritol hexaacrylate (DPHA), instead of polypropylene glycol diacrylate, was added as
25 photopolymerizable polyfunctional monomer in an amount as shown in Table 1. A pressure sensitive adhesive sheet was prepared in the same manner as in Example 1 except for the above.

[0111] [Evaluation]

<Light Transmittance of Pressure Sensitive Adhesive Sheet>

30 The release film on one surface of the pressure sensitive adhesive sheet was peeled off, the pressure sensitive adhesive sheet was bonded to an alkali-free glass plate, the release film on the other surface was then peeled off, and the transmission spectrum was measured with a UV-visible spectrophotometer (“U- 4100” manufactured by Hitachi

High-Technologies Corporation). From the obtained spectrum, light transmittances at wavelengths of 365 nm, 380 nm and 405 nm were read.

[0112] <Gel Fraction of Pressure Sensitive Adhesive Immediately after Preparation>

0.2 g of pressure sensitive adhesive is collected from the pressure sensitive adhesive sheet after the 3-days of aging treatment, and was used as a sample for measuring gel fraction. The sample was wrapped in a porous polytetrafluoroethylene film having pore diameter of 0.2 μm (manufactured by Nitto Denko Corporation; trade name: "NTF-1122") cut to a size of 100 mm $\times$ 100 mm, and the wrapped opening was tied with a kite string. The total weight (A) of the porous polytetrafluoroethylene film and the kite string measured beforehand was subtracted from the weight of this sample to calculate the weight (B) of the pressure sensitive adhesive sample. The pressure sensitive adhesive sample wrapped in the porous polytetrafluoroethylene film was immersed in approximately 50 mL of ethyl acetate at 23°C for 7 days to elute sol components of the pressure sensitive adhesive to the outside of the polytetrafluoroethylene film. After immersion, the pressure sensitive adhesive wrapped in the porous polytetrafluoroethylene film was taken out, dried at 130°C for 2 hours, and allowed to cool for about 20 minutes, and the dry weight (C) was measured. The gel fraction of the pressure sensitive adhesive was calculated from the following formula.

$$\text{gel fraction (\%)} = 100 \times (C - A) / B$$

[0113] <Gel Fraction of Pressure Sensitive Adhesive Sheet After Photocuring>

Using an UV lamp with an UVA energy density of 300 mW/cm², the pressure sensitive adhesive sheet immediately after the preparation was irradiated with an ultraviolet ray through the release film in a cumulative light amount of about 1000 mJ/cm², thereby photocuring the pressure sensitive adhesive. About 0.2g of pressure sensitive adhesive was scraped off from the pressure sensitive adhesive sheet after the photocuring, and the gel fraction was measured in the same manner as described above.

[0114] <Gel Fraction After Storage under Fluorescent Lamp>

A pressure sensitive adhesive sheet having a release film provided on both surfaces was left standing at a distance of 1.5 m from a fluorescent lamp (FLR32S • N/N-X manufactured by Panasonic Corporation; color temperature: 5000 K) for seven days. 0.2g of a pressure sensitive adhesive was scraped off, and the gel fraction was measured in the same manner as described above.

[0115] <Level Difference Followability>

The pressure sensitive adhesive sheet after storage under a fluorescent lamp for 1 week was cut to a size of 75 mm × 45 mm, and the release film on one surface was peeled off from the pressure sensitive adhesive sheet. Using a roll laminator (laminating pressure of 0.2 MPa and feeding speed of 100 mm/minute), the pressure sensitive adhesive sheet was bonded to the center of a polarizing plate (100 mm × 50 mm) with a 40 μm-thick triacetylcellulose film disposed on both surfaces of a polyvinyl alcohol-based polarizer. Thereafter, the release film on the other surface was peeled off from the pressure sensitive adhesive sheet, and a 500 μm-thick glass plate (100 mm × 50 mm) printed with a 20 μm-thick black ink in a frame pattern on the peripheral edge portion was bonded to the pressure sensitive adhesive sheet by a roll laminator (laminating pressure of 0.2 MPa and feeding speed of 100 mm/minute). The ink-printed region of the glass plate extended over 5 mm from both ends in the short side direction and 15 mm from the both ends in the long side direction, and the black ink layer was in contact with the region of 5 mm from the ends of the four sides of the pressure sensitive adhesive sheet. The sample was treated in an autoclave (50°C, 0.5 MPa) for 30 minutes, and then observed with a digital microscope at a magnification of 20 times to examine presence or absence of bubbles in the vicinity of the boundary of the black ink printed-region. A sample having no bubbles was rated “OK”, and a sample having bubbles was rated “NG”.

[0116] <Bonding Reliability After Photocuring>

A pressure sensitive adhesive sheet immediately after preparation was used to prepare a sample in which a polarizing plate was bonded to one surface of the pressure sensitive adhesive sheet and a glass plate with a black ink applied to a peripheral edge portion to form a frame pattern was bonded to the other surface as in the evaluation of level difference followability. Using an UV lamp with an UVA energy density of 300 mW/cm², the sample was irradiated with an ultraviolet ray in a cumulative light amount of about 1000 mJ/cm² from a surface on the glass plate side to photocure the pressure sensitive adhesive, followed by placing the sample in an oven at 85°C for 72 hours. For the sample taken out from the oven, whether air bubbles were present or not was determined in the same manner as in the level difference followability test. A sample having no bubbles was rated “OK”, and a sample having bubbles was rated “NG”.

[0117] Table 1 shows the compositions of pressure sensitive adhesives (the types and the amounts of polyfunctional monomers and the amounts of ultraviolet absorbers and photopolymerization initiators), the light transmittances and the gel fractions of pressure

sensitive adhesive sheets, and the results of evaluating level difference followability and bonding reliability in examples and comparative examples.

[0118] TABLE 1

	Composition (parts by weight)				Light transmittance (%)				Gel fraction(%)			Evaluation result	
	Polyfunctional monomer		UV absorber	Photo polymerization initiator	365 nm	380 nm	405 nm	420 nm	Immediately after preparation	After photocuring	Under fluorescent lamp for 7 days	Level difference followability before photocuring	Bonding reliability after photocuring
	APG 400	DPHA											
Example 1	2	-	0.7	0.2	0.02	7	86	91	51	66	52	OK	OK
Example 2	2	-	0.7	0.1	0.03	7	86	91	51	64	51	OK	OK
Example 3	2	-	0.8	0.2	0.01	5	85	91	51	62	51	OK	OK
Example 4	2	-	0.6	0.2	0.06	11	87	91	51	68	51	OK	OK
Example 5	2	-	0.5	0.2	0.14	18	88	91	51	67	52	OK	OK
Example 6	2	-	0.5	0.4	0.12	17	88	91	51	68	54	OK	OK
Example 7	-	2	0.7	0.2	0.02	7	86	91	51	86	53	OK	OK
Example 8	-	0.5	0.7	0.2	0.02	7	86	91	51	61	53	OK	OK
Comparative Example 1	2	-	0.7	0.6	0.02	7	86	91	51	65	60	NG	OK
Comparative Example 2	2	-	0.3	0.2	1.5	33	89	91	51	67	61	NG	OK
Comparative Example 3	2	-	1.0	0.2	0.00	2	84	90	51	55	53	OK	NG

[0119] The pressure sensitive adhesive sheets of Examples 1 to 7 had a small change in gel fraction after being left standing for 7 days under a fluorescent lamp, and had an increased gel fraction when irradiated with an ultraviolet ray at 1000 mJ/cm². Thus, these pressure sensitive adhesive sheets had excellent storage stability and photocuring efficiency. The pressure sensitive adhesive sheets of Comparative Examples 1 and 2 had a significantly increased gel fraction and reduced level difference followability after being left standing for 7 days under a fluorescent lamp.

[0120] In Comparative Example 2, photocuring progressed in a storage environment probably because the amount of the ultraviolet absorber was small, and the pressure sensitive adhesive sheet had high light transmittances at wavelengths of 380 nm and 365 nm. In Examples 1 and 2 and Comparative Example 1, there was no difference in amount of the ultraviolet absorber, and in Comparative Example 1 where the amount of the photopolymerization initiator was large, photocuring occurred in a storage environment. These results show that not only addition of the ultraviolet absorber but also the adjustment of the amount of the photopolymerization initiator is important for suppressing photocuring in a storage environment.

[0121] In Comparative Example 3 in which the amount of the ultraviolet absorber is 1.0 part by weight, the photocuring under a fluorescent lamp was suppressed, but even application of an ultraviolet ray at 1000 mJ/cm² did not sufficiently increase the gel fraction, and the pressure sensitive adhesive sheet was poor in bonding reliability. In Comparative Example 3, photocuring efficiency was deteriorated probably because the ultraviolet absorber absorbed a large amount of excitation light, and the photopolymerization initiator absorbed a small amount of light.

[0122] The above results show that storage stability can be compatible with photocuring efficiency by adding an ultraviolet absorber to a photocurable pressure sensitive adhesive sheet, adjusting the absorption property, and adjusting the type (absorption wavelength) and the amount of a photopolymerization initiator.

DESCRIPTION OF REFERENCE CHARACTERS

[0123]	5	pressure sensitive adhesive sheet
	1,2	release film
	3	polarizing plate
	4	pressure sensitive adhesive sheet

6	image display cell
10	image display panel
7	front transparent plate
100	image display device

5

Claims

1. A photocurable pressure sensitive adhesive sheet comprising a pressure sensitive adhesive composition deposited in a layer-form, wherein

5 the pressure sensitive adhesive composition contains a base polymer having a crosslinked structure, a photopolymerizable polyfunctional compound having two or more photopolymerizable functional groups per molecule, a photopolymerization initiator, and an ultraviolet absorber,

10 the pressure sensitive adhesive sheet having a light transmittance of 85% or more at a wavelength of 420 nm, a light transmittance of 80% or more at a wavelength of 405 nm, and a light transmittance of 4 to 25% at a wavelength of 380 nm.

2. The pressure sensitive adhesive sheet according to claim 1, having a light transmittance of 1% or less at a wavelength of 365 nm.

15 3. The pressure sensitive adhesive sheet according to claim 1 or 2, wherein the photopolymerization initiator has a light absorption coefficient of 50 [mLg⁻¹cm⁻¹] or less at a wavelength of 405 nm and a light absorption coefficient of 80 [mLg⁻¹cm⁻¹] or more at a wavelength of 380 nm.

20 4. The pressure sensitive adhesive sheet according to any one of claims 1 to 3, wherein the photopolymerization initiator has an absorption maximum in the wavelength range of 310 nm to 370 nm.

25 5. The pressure sensitive adhesive sheet according to any one of claims 1 to 4, wherein a content of the photopolymerization initiator is 0.05 to 1 part by weight based on 100 parts by weight of the base polymer.

30 6. The pressure sensitive adhesive sheet according to any one of claims 1 to 5, wherein a value of ϵw is 10 to 100, wherein

w is a weight parts content of the photopolymerization initiator based on 100 parts by weight of the base polymer,

ϵ is a light absorption coefficient of the photopolymerization initiator at a wavelength of 380 nm, wherein unit of ϵ is $\text{mLg}^{-1}\text{cm}^{-1}$, and
the ϵw is product of w and ϵ .

- 5 7. The pressure sensitive adhesive sheet according to any one of claims 1 to 6, wherein a value of ϵwT is 100 to 1200,
wherein

T is a percent light transmittance of the pressure sensitive adhesive sheet at a wavelength of 380 nm,

- 10 w is a weight parts content of the photopolymerization initiator based on 100 parts by weight of the base polymer,

ϵ is a light absorption coefficient of the photopolymerization initiator at a wavelength of 380 nm, wherein unit of ϵ is $\text{mLg}^{-1}\text{cm}^{-1}$, and
the ϵwT is product of T , w and ϵ .

15

8. The pressure sensitive adhesive sheet according to any one of claims 1 to 7, wherein the ultraviolet absorber is at least one selected from triazine-based compounds and benzotriazole-based compounds.

- 20 9. The pressure sensitive adhesive sheet according to any one of claims 1 to 8, wherein the base polymer includes an acryl-based polymer.

10. The pressure sensitive adhesive sheet according to any one of claims 1 to 9, wherein the base polymer includes a hydroxy group-containing component as a monomer unit, and
25 an isocyanate crosslinker is bonded to the hydroxy group of the hydroxy group-containing component.

11. The pressure sensitive adhesive sheet according to any one of claims 1 to 10, wherein the photopolymerizable polyfunctional compound is a polyfunctional (meth)acrylate.

30

12. The pressure sensitive adhesive sheet according to any one of claims 1 to 11, wherein a content of the photopolymerizable polyfunctional compound is 0.3 to 10 parts by weight based on 100 parts by weight of the base polymer.

5 13. The pressure sensitive adhesive sheet according to any one of claims 1 to 12, wherein a gel fraction is 30 to 80%.

14. The pressure sensitive adhesive sheet according to any one of claims 1 to 13, wherein a gel fraction of the pressure sensitive adhesive sheet after the pressure sensitive adhesive
10 sheet is photocured by application of an ultraviolet ray at 1000 mJ/cm² is higher by 5% or more than a gel fraction before the photocuring.

15. A pressure sensitive adhesive-equipped optical film, comprising:
an optical film;

15 a first pressure sensitive adhesive sheet stacked on a first principal surface of the optical film;

and a second pressure sensitive adhesive sheet stacked on a second principal surface of the optical film, wherein

the first pressure sensitive adhesive sheet is the pressure sensitive adhesive sheet
20 according to any one of claims 1 to 14.

16. A method for manufacturing an image display device including a transparent member having a level difference portion arranged on a viewing-side surface,

the method comprising

25 bonding the pressure sensitive adhesive sheet according to any one of claims 1 to 14 and the transparent member, and then

irradiating the pressure sensitive adhesive sheet with an active ray to photocure the pressure sensitive adhesive composition in the pressure sensitive adhesive sheet.