

COMPOSITION

TECHNICAL FIELD

[0001]

The present invention relates to a composition.

BACKGROUND ART

[0002]

Touch panels to be mounted on displays such as LCDs (liquid crystal displays) include resistive membrane type, capacitance type, electromagnetic induction type, optical type, and the like. These touch panels may have thereon decorative boards for improving visual designability or icon sheets for designating a position to be touched. The capacitive touch panel includes a structure in which a transparent electrode is formed on a transparent substrate, and a transparent plate is attached thereon.

[0003]

Conventionally, an adhesive has been used for bonding the decorative plate to the touch panel, the icon sheet to the touch panel, and the transparent substrate to the transparent plate.

[0004]

In particular, when these members are bonded together by a photocurable adhesive composition, the members may typically be bonded by laminating both the members together via the adhesive interposed therebetween, and then irradiating them with visible light or ultraviolet light from the front direction of the display to cure the adhesive.

[0005]

Patent Document 1 describes a photocurable resin composition comprising (A) a (meth)acrylate oligomer containing a polyisoprene, polybutadiene or polyurethane skeleton; (B) a softening component; and (C1) a (meth)acrylate monomer selected from phenoxyethyl (meth)acrylate, phenoxypolyethyleneglycol (meth)acrylate, 2-hydroxy-3-phenoxypropyl (meth)acrylate, cyclohexyl (meth)acrylate, nonylphenol

EO adduct (meth)acrylate, methoxytriethyleneglycol (meth)acrylate and tetrahydrofurfuryl (meth)acrylate. However, Patent Document 1 fails to describe the composition according to the present invention, particularly the composition containing (D) at least one dicarboxylic acid diester.

[0006]

Recently, glass for the display such as the LCD has become thinner. As the glass becomes thinner, the LCD is easier to deform by external stress. Bonding the display such as the LCD made of the thinner glass and an optically functional material such as an acryl plate or a polycarbonate plate occurs relaxation of molding distortion and absorption/drying of moisture in a heat resistance test and a moisture resistance test, whereby a change in surface accuracies such as a change in dimension and bending will occur, due to difference in linear expansion between the glass and the acryl or the like, or distortion during molding of a plastic molded material such as the acryl plate or the polycarbonate plate.

[0007]

Patent Document 2 describes a curable resin based on an urethane-based (meth)acrylate, a polybutadiene-based (meth)acrylate, and an isoprene-based (meth)acrylate. However, the conventional method described in Patent Document 2 cannot solve the deformation issues without peeling off the joining surfaces, breaking the LCDs, and display unevenness in the LCD.

[0008]

As a solution to the problems of Patent Document 2, Patent Document 3 describes a UV curable resin. However, Patent Document 3 relates to a highly elastic resin based on a rigid skeleton monomer such as isobornyl (meth)acrylate, so that the resin cannot withstand expansion and shrinkage of materials to be bonded in a high temperature reliability test, and peeling may occur. In contrast, the present invention aims to withstand the expansion and shrinkage of the materials to be bonded in the high temperature reliability test without using the rigid skeleton monomer such as isobornyl (meth)acrylate.

[0009]

In applications such as bonding of the decorative board to the touch panel, the icon

sheet to the touch panel, and the transparent substrate to the transparent plate, it would be desirable to have enough flexibility to follow deformation of the materials to be bonded in a warm atmosphere that simulates an operating environment.

[0010]

However, it has been found that enough flexibility to follow the deformation of the materials to be bonded in the warm atmosphere that simulates the operating environment might cause problems of coloration and discoloration after the heat resistance test and of a decrease in strength after the moisture resistance test. As a solution to those problems, Patent Document 4 discloses a photocurable adhesive composition comprising at least one oligomer selected from the group consisting of polyisoprene (meth)acrylate oligomers, polybutadiene (meth)acrylate oligomers and polyurethane (meth)acrylate oligomers, and a hindered amine. However, Patent Document 4 fails to describe the composition according to the present invention, particularly the composition containing (D) at least one dicarboxylic acid diester.

[0011]

Patent Document 5 discloses a particular sulfur-containing (meth)acrylate compound or a radical reactive composition containing the same, and a photocurable composition comprising a UV absorber, a photoinitiator and an antioxidant. However, Patent Document 5 fails to describe the composition according to the present invention, particularly the composition containing (D) at least one dicarboxylic acid diester.

[0012]

Patent Document 6 discloses a photocurable transparent adhesive composition comprising (A) a urethane (meth)acrylate containing two or more functional groups with an unsaturated double bond, (B) a monomer containing one functional group with an unsaturated double bond, (C) a photoinitiator, and (D) a polythiol compound containing two or more thiol groups, wherein the composition has a weight ratio of the urethane (meth)acrylate (A) in the composition of from 2% by weight to 30% by weight. However, Patent Document 6 fails to describe the composition according to the present invention, particularly the composition containing (D) at least one dicarboxylic acid diester.

[0013]

There has been a method of adding a tackifying agent in order to maintain a tackifying-adhesive property on a surface even after curing of an adhesive composition. Patent Document 7 describes a pressure sensitive acryl adhesive containing a hydrogenated rosin resin tackifier, an aliphatic fully-saturated hydrocarbon resin tackifier, or a hydrogenated terpene resin tackifier, as the tackifying agent. However, Patent Document 7 fails to describe the composition according to the present invention, particularly the composition containing (D) at least one dicarboxylic acid diester.

CITATION LIST

Patent Literature

[0014]

Patent Document 1: WO 2010/027041 A1

Patent Document 2: Japanese Patent Application Laid-open Publication No. 2004-077887 A1

Patent Document 3: Japanese Patent Application Laid-open Publication No. S64-085209 A1

Patent Document 4: Japanese Patent Application Laid-open Publication No. 2012-046658 A1

Patent Document 5: Japanese Patent Application Laid-open Publication No. 2002-097224 A1

Patent Document 6: Japanese Patent Application Laid-open Publication No. 2009-001655 A1

Patent Document 7: Japanese Patent Application Laid-open Publication No. 2006-225531 A1

SUMMARY OF INVENTION

Technical Problem

[0015]

The present invention provides a curable resin composition that can prevent peeling

off the bonded surfaces or cracking in the glass of a display body in the cases that a decorative plate and icon sheet used for the display body such as a touch panel are bonded to each other; transparent substrates are bonded to each other; and a display body and optical functional material are bonded to each other, that had not been overcome by the prior art. The present invention also solves the issues of discoloration and a decrease in strength after the heat resistance and moisture resistance tests.

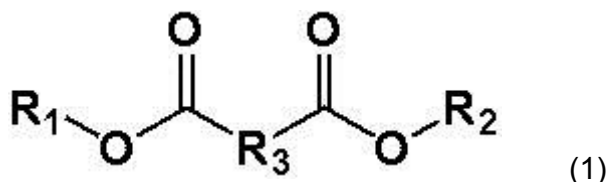
Solution to Problem

[0016]

Thus, an embodiment of the present invention may provide a composition comprising the following components (P) and (C) to (E):

- (P) a polymerizable vinyl compound;
- (C) a photoinitiator;
- (D) a dicarboxylic acid diester; and
- (E) a tackifying agent.

The composition may be characterized in that the component (D) is at least one dicarboxylic acid diester represented by the formula (1):



in which R₁ and R₂ which may be the same or different, each represents an alkyl group comprising 1 to 18 carbon atoms, and R₃ represents an alkylene group comprising 1 to 10 carbon atoms.

In the composition, the component (D) may comprise a sebacic acid diester. The composition may further comprise (F) a thiol, and the thiol may be polythiol. The composition may further comprise (G) an antioxidant. The polymerizable vinyl compound (P) may contain (A) a polyfunctional (meth)acrylate and (B) a monofunctional (meth)acrylate. The at least one polyfunctional (meth)acrylate (A) may comprise urethane (meth)acrylate, and at least one monofunctional (meth)acrylate (B) may comprise one or more selected from the group consisting of phenol

alkylene oxide-modified (meth)acrylates, alkyl (meth)acrylates, and hydroxyalkyl (meth)acrylates. An amount of the component (D) may be from 5 to 50 parts by mass per the total 100 parts by mass of the components (P) and (D). The tackifying agent (E) may comprise one or more selected from the group consisting of fully-hydrogenated rosin resins, aromatic-modified terpene resins, and terpene phenol resins. An embodiment of the present invention may further provide a curable resin composition comprising said composition, and an adhesive composition comprising said composition. A further embodiment of the present invention may provide a cured product of said adhesive composition, and a composite in which materials are covered or bonded by the cured product. In the composite, the materials may comprise one or more selected from the group consisting of triacetyl cellulose, fluorine-based polymers, polyesters, polycarbonates, polyolefins, glass, and metals. Further, an embodiment of the present invention may provide a touch panel laminate in which materials are laminated via the adhesive composition; a liquid crystal panel laminate in which materials are laminated via the adhesive composition; a display comprising the touch panel laminate, and a display comprising the liquid crystal panel laminate. Furthermore, an embodiment of the present invention may provide the adhesive composition, wherein the polymerizable vinyl compound (P) may contain (A) a polyfunctional (meth)acrylate and (B) a monofunctional (meth)acrylate; the polyfunctional (meth)acrylate (A) may comprise urethane (meth)acrylate; the monofunctional (meth)acrylate (B) may comprise one or more selected from the group consisting of phenol alkylene oxide-modified (meth)acrylates, alkyl (meth)acrylates, and hydroxyalkyl (meth)acrylates; the amount of the polyfunctional (meth)acrylate (A) may be from 10 to 90 parts by mass per the total 100 parts by weight of the components (A), (B) and (D); the amount of the monofunctional (meth)acrylate (B) may be from 3 to 80 parts by mass per the total 100 parts by mass of the components (A), (B) and (D); the amount of the dicarboxylic acid diester (D) used may be from 1 to 50 parts by mass per the total 100 parts by mass of the components (P) and (D); the tackifying agent (E) may comprise one or more selected from the group consisting of fully-hydrogenated rosin resins, aromatic-modified terpene resins, and terpene phenol resins; the amount of the tackifying agent (E)

may be from 1 to 40 parts by mass per the total 100 parts by mass of the components (P) and (D); the composition may further comprise from 0.1 to 10 parts by mass of (F) polythiol per the total 100 parts by mass of the components (P) and (D); and the composition may further comprise (G) at least one antioxidant.

Advantageous Effects of Invention

[0017]

An embodiment of the present invention can provide a composition that maintains adhesiveness on the surface even after curing, for example.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0018]

The polymerizable vinyl compound (P) may preferably be (meth)acrylates, and more preferably contain (A) polyfunctional (meth)acrylate and (B) monofunctional (meth)acrylate. The polyfunctional (meth)acrylate (A) refers to a (meth)acrylate containing two or more (meth)acryloyl groups. Examples of the polyfunctional (meth)acrylate include oligomers/polymers of polyfunctional (meth)acrylates containing two or more (meth)acryloyl groups at the ends or in the side chains of the oligomers/polymers.

[0019]

Examples of the oligomers/polymers of polyfunctional (meth)acrylates include 1,2-polybutadiene terminal urethane (meth)acrylates, 1,2-hydrogenated polybutadiene terminal urethane (meth)acrylates (for example, "TEAI-1000" available from NIPPON SODA CO., LTD.), 1,4-polybutadiene-terminus urethane (meth)acrylates, polyisoprene-terminus (meth)acrylates, polyester-based urethane (meth)acrylates, polyether-based urethane (meth)acrylates, and bisphenol A-type epoxy (meth)acrylates. The polybutadiene-terminus urethane (meth)acrylate or hydrogenated polybutadiene-terminus urethane (meth)acrylate includes a (meth)acrylate(s) at the end(s) of the molecular structure. Among them, urethane (meth)acrylates may be preferred in view of an improved effect. The urethane (meth)acrylates may preferably be one or more selected from the group consisting of polybutadiene-based

urethane (meth)acrylates, hydrogenated polybutadiene-terminus urethane (meth)acrylates, polyester-based urethane (meth)acrylates and polyether-based urethane (meth)acrylates, and more preferably one or more selected from the group consisting of hydrogenated polybutadiene urethane (meth)acrylates and polyester-based urethane (meth)acrylates. Among the hydrogenated polybutadiene urethane (meth)acrylates, 1,2-hydrogenated polybutadiene-terminus urethane (meth)acrylates may be preferred.

[0020]

The urethane (meth)acrylate as used herein refers to a urethane (meth)acrylate molecule containing a urethane bond(s) therein. The urethane (meth)acrylate may be obtained, for example, by a reaction (e.g., polycondensation reactions) of a polyol compound (hereinafter, referred to as X), an organic polyisocyanate compound (hereinafter, referred to as Y), and hydroxy (meth)acrylate (hereinafter, referred to as Z).

[0021]

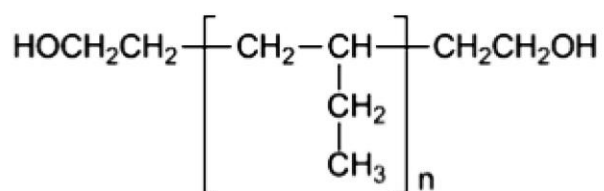
Examples of the polyol compound (X) include polyhydric alcohols such as ethylene glycol, diethylene glycol, triethylene glycol, tetraethylene glycol, polyethylene glycol, propylene glycol, dipropylene glycol, polypropylene glycol, butylene glycol, 1,4-butanediol, polybutylene glycol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,9-nonanediol, 3-methyl-1,5-pentanediol, 2,4-diethyl-1,5-pentanediol, 2,2-butylethyl-1,3-propanediol, neopentyl glycol, cyclohexane dimethanol, hydrogenated bisphenol A, polycaprolactone, trimethylolethane, trimethylolpropane, polytrimethylolpropane, pentaerythritol, polypentaerythritol, sorbitol, mannitol, glycerin, polyglycerin, and polytetramethylene glycol; polyether polyols containing at least one structure resulting from block or random copolymerization of polyethylene oxide, polypropylene oxide or ethylene oxide/propylene oxide; caprolactone-modified polyols such as caprolactone-modified polytetramethylene polyols; polyolefin-based polyols; polycarbonate-based polyols; polydiene-based polyols such as polybutadiene polyols, polyisoprene polyols, hydrogenated polybutadiene polyols and hydrogenated polyisoprene polyols; and silicone polyols such as polydimethylsiloxane polyols. Examples of the polyol compound (X) also include

polyester polyols resulting from condensation of the polyhydric alcohol or the polyol with a polybasic acid such as maleic anhydride, maleic acid, fumaric acid, itaconic anhydride, itaconic acid, adipic acid and isophthalic acid.

[0022]

The polyol compound (X), *inter alia*, may preferably be one or more selected from the group consisting of polybutadiene polyols, hydrogenated polybutadiene polyols, polyether polyols and polyester polyols, and more preferably one or more selected from the group consisting of hydrogenated polybutadiene polyols and polyester polyols. Among the hydrogenated polybutadiene polyols, a compound represented by the following formula (2) is preferred. (n is a positive number.)

[0023]



Formula (2)

in which n is a positive number.

[0024]

Here, in the polybutadiene urethane (meth)acrylate, the polyol compound (X) may be, for example, the polybutadiene polyol. In the polyester-based urethane (meth)acrylate, the polyol compound (X) may be, for example, the polyester polyol. In the polyether-based urethane (meth)acrylate, the polyol compound (X) may be, for example, the polyether polyol.

[0025]

The organic polyisocyanate compound (Y) may include, but not limited to, aromatic, aliphatic, cycloaliphatic and alicyclic polyisocyanates. Further examples of the organic polyisocyanate compound (Y) may include polyisocyanates such as tolylene diisocyanate (TDI), diphenylmethane diisocyanate (MDI), hydrogenated diphenylmethane diisocyanate (H-MDI), polyphenylmethane polyisocyanate (crude MDI), modified diphenylmethane diisocyanate (modified MDI), hydrogenated xylene diisocyanate (H-XDI), xylene diisocyanate (XDI), hexamethylene

diisocyanate (HMDI), trimethylhexamethylene diisocyanate (TMXDI), tetramethylxylylene diisocyanate (m-TMXDI), isophorone diisocyanate (IPDI), norbornene diisocyanate (NBDI) and 1,3-bis(isocyanatomethyl)cyclohexane (H6XDI); trimers of these polyisocyanates; reaction products of these polyisocyanates with polyols. Among them, hydrogenated xylylene diisocyanate (H-XDI) and/or isophorone diisocyanate (IPDI) are preferred.

[0026]

Examples of the hydroxy (meth)acrylate (Z) may include hydroxyalkyl (meth)acrylates such as 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate and 2-hydroxybutyl (meth)acrylate; 2-hydroxyethyl (meth)acryloyl phosphate, 4-hydroxybutyl (meth)acrylate, 2-(meth)acryloyloxyethyl-2-hydroxypropyl phthalate, glycerin di(meth)acrylate, 2-hydroxy-3-(meth)acryloyloxypropyl acrylate, caprolactone-modified 2-hydroxyethyl (meth)acrylate, pentaerythritol tri(meth)acrylate, dipentaerythritol penta(meth)acrylate, and caprolactone-modified 2-hydroxyethyl (meth)acrylates. Among them, the hydroxyalkyl (meth)acrylates are preferred.

[0027]

Among the hydroxyalkyl (meth)acrylates, hydroxyalkyl (meth)acrylates represented by the following formula (3) may be preferred:



in which Z represents a (meth)acryloyl group, R_4 represents an alkylene group, and p represents an integer of 1 to 10.

[0028]

The alkylene group R_4 in the formula (3) may preferably contain from 1 to 8 carbon atoms, and more preferably 2 to 6 carbon atoms.

[0029]

The hydroxyalkyl (meth)acrylates may preferably be one or more selected from the group consisting of 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate and 4-hydroxybutyl (meth)acrylate. Methods for producing the urethane (meth)acrylates are described, for example, in JP H07-025957 A1, JP 2002-173515 A1, JP H07-292048 A1, and JP 2000-351819 A1.

[0030]

The polyfunctional (meth)acrylate may preferably have the weight average molecular weight of from 1,000 to 60,000, and more preferably from 1,500 to 40,000. The weight average molecular weight is determined from a calibration curve prepared using a commercially available standard polystyrene, based on measurement under conditions as described below with a GPC system (SC-8010 available from TOSOH CORPORATION) or the like using tetrahydrofuran as a solvent.

[0031]

Flow Rate: 1.0 ml/min;

Set Temperature: 40 °C;

Column Structure: total three columns (theoretical plate number: 32,000 in total); one column is "TSK guardcolumn MP (×L)" from TOSOH CORPORATION, having 6.0 mm ID × 4.0 cm, and the other two columns are "TSK-GELMULTIPOREHXL-M" from TOSOH CORPORATION, each having 7.8 mm ID × 30.0 cm (theoretical plate number: 16,000);

Sample Injection Amount: 100 µl (sample solution concentration of 1 mg/ml);

Pressure for Delivering Solution: 39 kg/cm²; and

Detector: RI detector.

[0032]

In the case that the polymerizable vinyl compound (P) contains the polyfunctional (meth)acrylate (A) and the monofunctional (meth)acrylate (B), the amount of the polyfunctional (meth)acrylate (A) may preferably be from 10 to 90 parts by mass, and more preferably from 30 to 90 parts by mass, and still more preferably from 40 to 85 parts by mass, and even more preferably from 30 to 80 parts by mass, and most preferably from 40 to 75 parts by mass, per the total 100 parts by mass of the components (A), (B) and (D). If the amount of the component (A) is 10 parts by mass or more, no reduction of adhesiveness will occur, and if it is 90 parts by mass or less, good curability will be obtained.

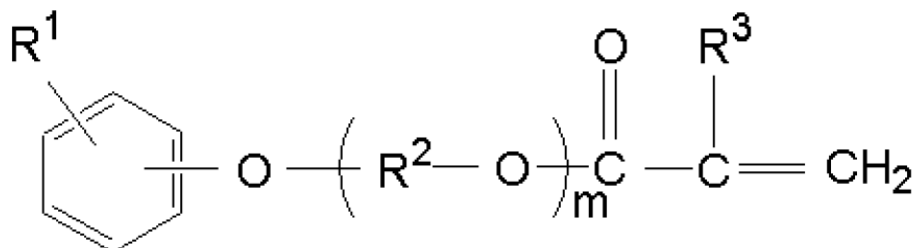
[0033]

The monofunctional (meth)acrylate (B) refers to a (meth)acrylate containing one (meth)acryloyl group. The monofunctional (meth)acrylate (B) may preferably be

one or more selected from the group consisting of phenol alkylene oxide-modified (meth)acrylates, alkyl (meth)acrylates and hydroxyalkyl (meth)acrylates.

Among the phenol alkylene oxide-modified (meth)acrylates, phenol alkylene oxide-modified (meth)acrylates represented by the following formula (4) may be preferable:

[0034]



Formula (4)

in which R¹ is hydrogen or an alkyl group containing 1 to 16 carbon atoms, R² is an alkylene group, R³ is hydrogen or a methyl group, and m is from 1 to 6.

[0035]

R¹ may preferably be an alkyl group. Preferably, the alkyl group may contain 5 to 13 carbon atoms, and more preferably 9 carbon atoms. R² may preferably be an ethylene group. m may preferably be 4. Examples of nonylphenol alkylene oxide-modified (meth)acrylates in which R¹ is the alkyl group containing 9 carbon atoms may include nonylphenol ethylene oxide-modified (meth)acrylates, nonylphenol (4 mol ethylene oxide-modified) (meth)acrylates, nonylphenol (8 mol ethylene oxide-modified) (meth)acrylates, and nonylphenol (2.5 mol propylene oxide-modified) (meth)acrylates.

[0036]

Among the alkyl (meth)acrylates, alkyl (meth)acrylates comprising an alkyl group(s) with 2 to 16 carbon atoms are preferable. Preferably, the alkyl group may be a saturated aliphatic hydrocarbon group. More preferably, the alkyl group may be unsubstituted.

[0037]

The alkyl (meth)acrylates comprising an alkyl group(s) with 2 to 16 carbon atoms may include ethyl (meth)acrylate, propyl (meth)acrylate, butyl (meth)acrylate, 2-

ethylhexyl (meth)acrylate, n-octyl (meth)acrylate, iso-octyl (meth)acrylate, decyl (meth)acrylate, isodecyl (meth)acrylate, lauryl (meth)acrylate, stearyl (meth)acrylate, and iso-stearyl (meth)acrylate. Among them, octyl (meth)acrylate may be preferred, and n-octyl (meth)acrylate may be more preferred, in terms of adhesiveness and moisture resistance.

[0038]

Among the hydroxyalkyl (meth)acrylates, hydroxyalkyl (meth)acrylates represented by the above formula (3) may be preferred:



in which Z represents a (meth)acryloyl group, R₄ represents an alkylene group, and p represents an integer of from 1 to 10.

[0039]

The alkylene group of R₄ in the formula (3) may preferably contain 1 to 8 carbon atoms, and more preferably 2 to 6 carbon atoms.

[0040]

The hydroxyalkyl (meth)acrylates may include 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, 2-hydroxybutyl (meth)acrylate, 4-hydroxybutyl (meth)acrylate, diethylene glycol mono(meth)acrylate and polypropylene glycol (meth)acrylate. Among them, 4-hydroxybutyl (meth)acrylate may be preferable in terms of adhesiveness and moisture resistance.

[0041]

In the case that the polymerizable vinyl compound (P) contains the polyfunctional (meth)acrylate (A) and the monofunctional (meth)acrylate (B), the amount of the monofunctional (meth)acrylate (B) may preferably be from 3 to 80 parts by mass, and more preferably from 5 to 80 parts by mass, and still more preferably from 15 to 65 parts by mass, and even more preferably from 20 to 60 parts by mass, per the total 100 parts by mass of the components (A), (B) and (D). If the amount of the component (B) is 3 parts by mass or more, good curability will be obtained, and if it is 80 parts by mass or less, the adhesiveness will not be decreased.

[0042]

The photoinitiator (C) promotes photocuring of the resin composition by sensitization

with active light such as visible light and ultraviolet light. Examples of the photoinitiator may include benzophenone and derivatives thereof, benzyl and derivatives thereof, anthraquinone and derivatives thereof, benzoin and benzoin derivatives such as benzoin methyl ether, benzoin ethyl ether, benzoin propyl ether, benzoin isobutyl ether and benzyl dimethyl ketal, acetophenone derivatives such as diethoxyacetophenone and 4-t-butyltrichloroacetophenone, 2-dimethylaminoethyl benzoate, p-dimethylaminoethyl benzoate, diphenyl disulfide, thioxanthone and derivatives thereof, camphorquinone and camphorquinone derivatives such as 7,7-dimethyl-2,3-dioxobicyclo[2.2.1]heptane-1-carboxylic acid, 7,7-dimethyl-2,3-dioxobicyclo[2.2.1]heptane-1-carboxy-2-bromoethyl ester, 7,7-dimethyl-2,3-dioxobicyclo[2.2.1]heptane-1-carboxy-2-methyl ester, 7,7-dimethyl-2,3-dioxobicyclo[2.2.1]heptane-1-carboxylic acid chloride, α -aminoalkylphenone derivatives such as 2-methyl-1-[4-(methylthio)phenyl]-2-morpholinopropane-1-one and 2-benzyl-2-dimethylamino-1-(4-morpholinophenyl)-butanone-1, acylphosphine oxide derivatives such as benzoyldiphenylphosphine oxide, 2,4,6-trimethylbenzoyldiphenylphosphine oxide, benzoyldiethoxyphosphine oxide, 2,4,6-trimethylbenzoyldimethoxyphenylphosphine oxide, 2,4,6-trimethylbenzoyldiethoxyphenylphosphine oxide and bis(2,4,6-trimethylbenzoyl)-phenylphosphine oxide, oxy-phenyl-acetic acid 2-[2-oxo-2-phenyl-acetoxy-ethoxy]-ethyl ester and oxy-phenyl-acetic acid 2-[2-hydroxy-ethoxy], and 1-hydroxy-cyclohexyl-phenyl-ketone. The photoinitiator may be used alone or in combination of two or more of the above-listed photoinitiators. Among them, one or more selected from the group consisting of the benzoin derivatives, 1-hydroxy-cyclohexyl-phenyl-ketone, and the acylphosphine oxide derivatives may be preferable in terms of an improved effect. Among the benzoin derivatives, benzyl dimethyl ketal may be preferred. Among the acylphosphine oxide derivatives, one or more selected from the group consisting of 2,4,6-trimethylbenzoyldiphenylphosphine oxide and bis(2,4,6-trimethylbenzoyl)-phenylphosphine oxide may be preferred.

[0043]

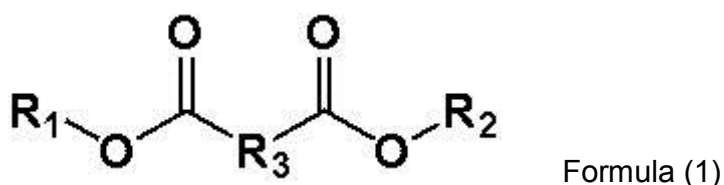
The amount of the photoinitiator (C) may preferably be from 0.01 to 10 parts by mass, and more preferably from 0.1 to 1 part by mass, per the total 100 parts by mass of

the components (A), (B) and (D). If the amount of the component (C) is 0.01 parts by mass or more, good curability will be obtained, and if it is 10 parts by weight or less, good deep curability will be obtained.

[0044]

The dicarboxylic acid diester (D) may preferably be an aliphatic dibasic acid diester. The aliphatic dibasic acid diester may preferably at least one compound represented by the following formula (1):

[0045]



in which R₁, R₂ and R₃ are as defined above.

[0046]

Preferably, each of R₁ and R₂ of the compound represented by the formula (1) may be a saturated aliphatic hydrocarbon group. Further, R₁ and R₂ may preferably be unsubstituted. Preferably, each of R₁ and R₂ may be an alkyl group containing 2 to 12 carbon atoms, and more preferably an alkyl group containing 4 to 10 carbon atoms, and most preferably an alkyl group containing 8 carbon atoms. Preferably, R₃ of the compound represented by the formula (1) may be a saturated aliphatic hydrocarbon group. Preferably, R₃ may be unsubstituted. Preferably, R₃ may be an alkylene group containing 4 to 10 carbon atoms, and more preferably an alkylene group containing 7 to 8 carbon atoms, and most preferably an alkylene group containing 8 carbon atoms.

[0047]

The dicarboxylic acid diester (D) improves deep curability and adjusting viscosity, for example.

[0048]

The dicarboxylic acid diester (D) represented by the formula (1) may include dimethyl oxalate, diethyl oxalate, dipropyl oxalate, diisopropyl oxalate, dibutyl oxalate, dihexyl oxalate, dioctyl oxalate, diisopropyl malonate, dibutyl malonate, diethyl succinate, dipropyl succinate, diisopropyl succinate, dibutyl succinate, di-t-butyl succinate,

bis(2-ethylhexyl) succinate, bis(2-ethoxyethyl) succinate, diethyl glutarate, dibutyl glutarate, dimethyl adipate, diethyl adipate, dipropyl adipate, diisopropyl adipate, butyl adipate, di-t-butyl adipate, bis(2-ethylhexyl) adipate, dioctyl adipate, dimethyl pimelate, diethyl pimelate, diisopropyl pimelate, dibutyl pimelate, dimethyl suberate, diethyl suberate, dipropyl suberate, diisopropyl suberate, dimethyl azelate, diethyl azelate, dipropyl azelate, diisopropyl azelate, dibutyl azelate, dimethyl sebacate, diethyl sebacate, dipropyl sebacate, dipropyl sebacate, diisopropyl sebacate, dibutyl sebacate, and bis(2-ethylhexyl) sebacate. The dicarboxylic acid diesters can be used alone or in combination of two or more. Among the dicarboxylic acid diesters (D), the sebacates may be preferred. Among the sebacates, bis(2-ethylhexyl) sebacate may be preferred.

[0049]

The amount of the dicarboxylic acid diester (D) may preferably be from 1 to 50 parts by mass, and more preferably from 5 to 45 parts by mass, and most preferably from 8 to 20 parts by mass, per the total 100 parts by mass of the components (P) and (D). If the amount of the component (D) is 1 part by mass or more, good viscosity will be obtained, and if it is 50 parts by mass or less, good deep curability will be obtained.

[0050]

Generally, the tackifying agent (E) is also known as a tackifier or a tackifying resin and is used for maintaining tackiness on the surface of an adhesive-cured product even after curing. The preferable tackifying agents may be those which are less liable to cause deterioration due to ultraviolet light and have high weather resistance. Examples of the tackifying agent may include hydrogenated rosin resins (fully-hydrogenated rosin resins), aliphatic fully-saturated hydrocarbon resins, hydrogenated terpene resins (fully-hydrogenated terpene resins), aromatic-modified hydrogenated terpene resins, aromatic-modified terpene resins, styrene resins, terpene phenol resins, and hydrogenated terpene phenol resins. More preferably, the tackifying agent, among others, may be one or more selected from the group consisting of fully-hydrogenated rosin resins, aromatic-modified terpene resins and terpene phenol resins.

[0051]

The amount of the tackifying agent (E) may preferably be from 1 to 40 parts by mass, and more preferably 3 to 30 parts by mass, and even more preferably 5 to 25 parts by mass, and most preferably 10 to 20 parts by mass, per the total 100 parts by mass of the components (P) and (D). If the amount of the component (E) is 1 part by mass or more, good adhesion will be obtained on the surface after curing, and if it is 40 parts by mass or less, good transparency will be obtained.

[0052]

The composition according to an embodiment of the present invention may include (F) thiol. The thiol (F) refers to a compound containing one or more thiol groups. Among the thiols, polythiols may be preferable in terms of deep curability. The polythiol (F) refers to a compound containing two or more thiol groups. The polythiols may include trimethylolpropane tris(thiopropionate), pentaerythritol tetrakis(thiopropionate), dipentaerythritol hexakis(3-mercaptopropionate), tris[(3-mercaptopropionyloxy)ethyl]isocyanurate, 2-ethylhexyl-3-mercaptopropionate, and 3-mercaptobutyrate derivatives. The polythiols may be used alone or in combination of two or more.

[0053]

Preferably, the polythiol (F) may be one or more selected from the group consisting of 3-mercaptobutyrate derivatives and mercaptopropionate derivatives. Examples of the polythiol may include 1,4-bis(3-mercaptobutyryloxy)butane, 1,3,5-tris(3-mercaptobutyloxyethyl)-1,3,5-triazine-2,4,6-(1H,3H,5H)-trione, pentaerythritol tetrakis(3-mercaptobutyrate), pentaerythritol tetrakis(3-mercaptobutyrate), trimethylolpropane tris(3-mercaptopropionate), and 2-ethylhexyl-3-mercaptopropionate. Among the polythiols (F), primary or secondary polythiols may be preferred.

[0054]

The amount of the polythiol (F) may preferably be from 0.1 to 10 parts by mass, and more preferably 0.5 to 5 parts by mass, per the total 100 parts by mass of the components (P) and (D). If the amount of the polythiol (F) is 0.1 parts by mass or more, good deep curability will be obtained, and if it is 10 parts by mass or less,

coloration and discoloration of the curable resin composition due to heat will be reduced.

[0055]

The composition according to an embodiment of the present invention may contain (G) antioxidant for improving storage stability. Examples of the antioxidant include methylhydroquinone, hydroquinone, 2,2-methylene-bis(4-methyl-6-tert-butylphenol), 6-tert-butyl-4-[3-[(2,4,8,10-tetra-tert-butyl-dibenzo[d,f][1,3,2]dioxaphosphin-6-yl)oxy] propyl]-2-methylphenol, catechol, hydroquinone monomethyl ether, mono-tert-butylhydroquinone, 2,5-di-tert-butylhydroquinone, p-benzoquinone, 2,5-diphenyl-p-benzoquinone, 2,5-di-tert-butyl-p-benzoquinone, picric acid, citric acid, phenothiazine, tert-butylcatechol, 2-butyl-4-hydroxyanisole and 2,6-di-tert-butyl-p-cresol. Among them, 6-tert-butyl-4-[3-[(2,4,8,10-tetra-tert-butyl-dibenzo[d,f][1,3,2]dioxaphosphin-6-yl)oxy] propyl]-2-methylphenol may be preferred.

[0056]

The amount of the antioxidant (G) may preferably be from 0.001 to 0.5 part by mass, and more preferably from 0.005 to 0.1 part by mass, per the total 100 parts by mass of the components (P) and (D). If the amount of the antioxidant (G) is 0.001 parts by mass or more, coloration or discoloration of the curable resin composition due to heat will be reduced, and if it is 0.5 part by mass or less, good deep curability will be obtained.

[0057]

The composition according to an embodiment of the present invention may contain various elastomers such as acryl rubbers, urethane rubbers and acrylonitrile-butadiene-styrene rubbers; solvents such as polar organic solvents; and additives such as fillers, reinforcing materials, plasticizers, thickeners, dyes, pigments, flame retardants, silane coupling agents and surfactants that are generally used in the art, as long as the objects of the present invention are not impaired.

[0058]

The cured product bonded by the composition according to the present invention can be reworked or reused after complete curing. The reworking may be carried out by

applying a load of 0.01 to 100 N between one or two bonded materials to disassemble the bonded materials to each other and then reusing the disassembled bonded materials, although not particularly limited to the specific method.

[0059]

The composition according to an embodiment of the present invention may be, for example, a curable resin composition, and may be also used as an adhesive composition. The composition according to an embodiment of the present invention may maintain sufficient adhesiveness/tackiness to attach various materials to be bonded, even if the composition is cured into a cured product having a curing rate of 90% or more. The composition according to an embodiment of the present invention may be an adhesive composition that can bond materials together, such as by irradiating the adhesive composition applied onto one material with visible light or ultraviolet light and then bonding the one material to other material, so that portions where visible light or ultraviolet light is not transmitted can also be cured.

[0060]

The adhesive composition according to an embodiment of the present invention can provide a cured product of the adhesive composition, for example, by irradiation with visible light or ultraviolet light.

[0061]

It is possible to obtain a composite in which the material(s) to be bonded is/are covered or bonded by the cured product according to an embodiment of the present invention. The materials to be bonded include, but not particularly limited to, preferably one or more selected from the group consisting of triacetylcellulose, fluorine-based polymers, polyesters, polycarbonates, polyolefins, glass, and metals.

[0062]

It is possible to obtain a touch panel laminate in which the materials to be bonded are laminated to each other by using the adhesive composition according to an embodiment of the present invention.

It is possible to obtain a touch panel laminate in which the materials to be bonded are laminated to each other by using the adhesive composition according to an embodiment of the present invention. A display can be obtained using the touch

panel laminate.

It is possible to obtain a liquid crystal panel laminate in which the materials to be bonded are laminated by using the adhesive composition according to an embodiment of the present invention. A display can be obtained using the liquid crystal panel laminate.

EXAMPLES

[0063]

Hereinafter, the present invention will be described in more detail with reference to experimental examples, but the present invention is not limited thereto. Experiments were carried out at 23 °C unless otherwise specified.

[0064]

Experimental example 1

Curable resin compositions having the formulations as shown in Table 1 were prepared and evaluated. Results are shown in Table 1.

[0065]

As each component in the curable resin compositions described in the Examples, the following compounds were selected:

[0066]

As the polyfunctional (meth)acrylate of component (A), the following compounds were selected:

(A-2) a polyester-based urethane acrylate oligomer ("Oligomer 2") in which the polyol compounds are a polyester polyol resulting from condensation of 1,4-butanediol with adipic acid and a polyester polyol resulting from condensation of ethylene glycol with adipic acid (polyester polyol resulting from condensation of 1,4-butanediol with adipic acid : polyester polyol resulting from condensation of ethylene glycol with adipic acid = 2 : 3 (molar ratio)); the organic polyisocyanate compound is isophorone diisocyanate; the hydroxy (meth)acrylate is 2-hydroxyethyl acrylate; and having a weight average molecular weight of 18,000 in terms of polystyrene, measured by GPC;

(A-1) a polyester-based urethane acrylate oligomer ("Oligomer 1") in which the polyol

compound is a polyester polyol resulting from condensation of hydrogenated polybutadiene polyol with adipic acid; the organic polyisocyanate compound is isophorone diisocyanate; the hydroxy (meth)acrylate is 4-hydroxybutyl acrylate; and the hydrogenated polybutadiene polyol is the compound represented by the formula (3) where n is a positive number; and having a weight average molecular weight of 25,000 in terms of polystyrene, measured by GPC;

(A-3) a hydrogenated polybutadiene-based urethane acrylate ("Oligomer 3") which is an urethane acrylate including a hydrogenated polybutadiene skeleton, and in which the polyol compound is hydrogenated polybutadiene polyol; the organic polyisocyanate compound is isophorone diisocyanate; the hydroxy (meth)acrylate is 2-hydroxyethyl acrylate; and the hydrogenated polybutadiene polyol is the compound represented by the formula (2) where n is a positive number; and having a weight average molecular weight of 19,000;

(A-4) a hydrogenated polybutadiene urethane acrylate ("Oligomer 4") which is an urethane acrylate containing 20% by mass of n-octyl acrylate as a diluent monomer and a hydrogenated polybutadiene skeleton; and in which the polyol compound is hydrogenated polybutadiene polyol; the organic polyisocyanate compound is isophorone diisocyanate; the hydroxy (meth)acrylate is 2-hydroxyethyl acrylate; and the hydrogenated polybutadiene polyol is the compound represented by the formula (2) where n is a positive number; and having a weight average molecular weight of 35,000.

[0067]

As the monofunctional (meth)acrylate of the component (B), the following compounds were selected:

(B-1) nonylphenoxypolyethylene glycol acrylate (m is 4 in the formula (4) ("M-113" available from TOAGOSEI CO., LTD.);

(B-2) lauryl acrylate ("LA" available from OSAKA ORGANIC CHEMICAL INDUSTRY LTD.);

(B-3) 4-hydroxybutyl (meth)acrylate ("4HBA" available from Nippon Kasei Chemical Co., Ltd.);

(B-4) n-octyl acrylate (hereinafter, abbreviated as "NOAA").

[0068]

As the photoinitiator of the component (C), the following compounds were selected;

(C-1) 1-hydroxycyclohexyl phenyl ketone ("Irgacure 184" available from BASF);

(C-2) 2,4,6-trimethylbenzoyl-diphenyl-phosphine oxide ("Lucirin TPO" available from BASF);

(C-3) bis(2,4,6-trimethylbenzoyl)phenylphosphine oxide ("Irgacure 819" available from BASF).

[0069]

As the dicarboxylic acid diester of the component (D), the following compounds were selected:

(D-1) bis(2-ethylhexyl) sebacate ("Sansocizer DOS" available from New Japan Chemical Co., Ltd.) (hereinafter, abbreviated as "DOS");

(D-2) bis(2-ethylhexyl) adipate (hereinafter, abbreviated as "DOA").

[0070]

As the tackifying agent of component (E), the following compounds were selected:

(E-1) HALITACK F85, a fully-hydrogenated rosin resin available from Harima Chemicals Group, Inc.;

(E-2) YS RESIN TR105, an aromatic-modified terpene resin available from YASUHARA CHEMICAL CO., LTD.;

(E-3) YS POLYSTAR TH130, a terpene phenol resin available from YASUHARA CHEMICAL CO., LTD.

[0071]

As the thiol compound of the component (F), the following compounds were selected:

(F-1) pentaerythritol tetrakis(3-mercaptopropionate) ("Karenc MT PE1" available from SHOWA DENKO KK; hereinafter, abbreviated as "MT-PE1");

(F-2) 2-ethylhexyl-3-mercaptopropionate ("EHMP" available from SC Organic Chemical Industry Co., Ltd.).

[0072]

As the antioxidant of component (G), the following compound was selected:

(G-1) 6-tert-butyl-4-[3-[(2,4,8,10-tetra-tert-butyl)benzo[d,f][1,3,2]dioxaphosphin-6-yl]oxy] propyl]-2-methylphenol ("SUMILIZER GP" available from Sumitomo

Chemical Co., Ltd.; hereinafter, abbreviated as "GP").

[0073]

Various properties were measured as follows:

[0074]

[Photocurability]

Measurement was carried out at a temperature of 23 °C. For measurement of the photocurability, each curable resin composition was applied to a surface of TEMPAX glass (25 mm width × 25 mm length × 2 mm thickness) so as to have the thickness of 0.1 mm. Each curable resin composition was then cured by irradiating it with UV light having a wavelength of 365 nm under a condition of a cumulative light quantity of 1,500 mJ/cm, using a curing apparatus from Fusion Inc. with an electrodeless discharge lamp.

A curing rate was calculated from the following equation, based on measurement using FT-IR. For the absorption spectrum of the carbon-carbon double bond, a peak around 1600 cm⁻¹ was used.

(Curing rate) = 100 - (intensity of absorption spectrum of carbon-carbon double bond after curing) / (intensity of absorption spectrum of carbon-carbon double bond before curing) × 100 (%).

[0075]

[Evaluation of Glass Adhesion (Glass Tensile Strength Evaluation)]

Each curable resin composition was applied in the form of circle having the radius of 4 mm onto a center portion of a slide glass test piece (commercially available product having 20 mm width × 76 mm length × 1.1 mm thickness) using Teflon® tape having a thickness of 200 μm × a width of 20 mm × a length of 20 mm as a spacer, and then cured by irradiating the composition with light. After curing the curable resin composition according to the light irradiation conditions as described above in the section of "Photocurability", the slide glass test piece was stacked to a slide glass test piece with the same size so as to form a cross shape and adhered to each other by applying a pressure of 1 kgf/cm² (an adhesion area of 50 mm²). After allowing the slide glass test pieces to adhere to each other under the above conditions, pressure was applied only to one of the slide glass test pieces bonded in the cross

shape using a universal testing machine, and tensile strength (unit: kPa) was measured. The tensile strength was measured at a temperature of 23 °C and a humidity of 50% at a rate of 10 mm/min.

[0076]

[Evaluation of Polycarbonate Adhesion (Polycarbonate Tensile Strength Evaluation)]

Each curable resin composition was applied in the form of circle having a radius of 4 mm onto a center portion of a polycarbonate test piece ("Panlite" available from TEIJIN LIMITED, having 25 mm width × 25 mm length × 2.0 mm thickness) using Teflon® tape having a thickness of 200 µm × a width of 20 mm × a length of 20 mm as a spacer, and then cured by irradiating the composition with light. After curing the curable composition according to the light irradiation conditions as described above in the section of "Photocurability", the polycarbonate test piece is stacked to a polycarbonate test piece with the same size so as to form a cross shape and adhered to each other by applying a pressure of 1 kgf/cm² (an adhesion area of 50 mm²). After allowing the polycarbonate test pieces to adhere to each other under the above conditions, pressure was applied only to one of the polycarbonate test pieces bonded in the cross shape using a universal testing machine, and tensile strength (unit: kPa) was measured. The tensile strength was measured at a temperature of 23 °C and a humidity of 50% at a rate of 10 mm/min.

[0077]

[Moisture Heat Resistance Evaluation (Appearance Observation (Degree of Yellowing))]

One EAGLE XG® glass (50 mm width × 70 mm length × 0.7 mm thickness) adhered to other same glass using each curable resin composition so as to provide a layer thickness of the curable resin composition of 200 µm, and the composition was then cured. The light irradiation was carried out under the conditions as described above in the section of "Photocurability". After curing, the adhered test piece was placed in a temperature and humidity testing chamber at a temperature of 85 °C and a relative humidity of 95% for 1000 hours. After exposure to such an environment, Δb value of the bonded test piece was measured by a color measuring device ("UV-VISIBLE SPECTROPHOTOMETER" available from SHIMADZU) to provide a degree

of yellowing.

[0078]

[Table 1]

Example Nos.	-	Unit	EX. 1	EX. 2	EX. 3	EX. 4	EX. 5	EX. 6	EX. 7	EX. 8	EX. 9	EX. 10	EX. 11	EX. 12	EX. 13	COMP.1
(A) Component (parts by mass)	Oligomer 1	Parts By Mass	40													
	Oligomer 2			40												
	Oligomer 3				45	45	45	45								
	Oligomer 4								48	56	56	56	48	56	85	48
(B) Component (parts by mass)	M113		50	50	25											
	LA					25	25	25								
	4HBA								10	10	10	10	10	10	5	10
	NOAA				20	20	20	20	12	14	14	14	12	14		12
(C) Component (parts by mass)	Irgacure-184		0.3	0.3	0.3	0.3	0.3	0.3								
	LucirinTPO		0.15	0.15	0.15	0.15	0.15	0.15	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
	Irgacure-819								0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
	DOS		10	10	10	10	10	10	30	20	20	20	30		10	30
(D) Component (parts by mass)	DOA													20		
(E) Component (parts by mass)	HARITACK F85		20						20	20			20			
	YS RESIN TR105			20	20						20					
	YS POLYSTAR TH130					10	20	30				20		20	30	
(F) Component (parts by mass)	MT-PE1		2	2	2	2	2	2								
(G) Component (parts by mass)	EHMP								2	2	2	2		2		2
	GP		0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Curability Test	Photocurability	%	95	96	98	96	96	93	>99	>99	>99	>99	>99	>99	97	>99
Adhesion Test	Glass Tensile Strength Evaluation	kPa	540	600	430	350	420	480	600	600	540	500	600	470	590	50
	Polycarbonate Tensile Strength Evaluation	kPa	660	600	600	300	480	530	180	300	240	220	180	200	170	20
Reliability Test	Humidity Heat Resistance Evaluation (Appearance Observation (Degree of Yellowing))		No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)	No Yellowing (0)

[0079]

As can be seen from Table 1, the present invention produces advantageous effects. If the tackifying agent is not used (Comparative Example 1), the adhesiveness is decreased and the effect of the present invention cannot be obtained. The increased amount of the tackifying agent leads to decreased transparency and decreased curability (Example 6).

[0080]

Experimental example 2

Deep curability was evaluated using each curable resin composition having the formulations as shown in Table 2. Results are shown in Table 2.

[0081]

[Deep Curability]

Each curable resin composition was filled into a black tube having a length of 20 mm and a hole with a diameter of 5 mm ϕ , and irradiated with light of 1 mW/cm² (365 nm) by black light from the upper for 100 seconds (the cumulative light quantity was 100 mJ/cm²). The resulting cured product was then taken out from the black tube, uncured portions were removed, and thickness of the cured portion was measured by a micrometer.

[0082]

[Table 2]

Example Nos.	-	Unit	Example 7	Example 11
Curability Test	Deep Curability	mm	3.1	2.4

[0083]

As can be seen from Table 2, if the thiol is used, deep curability can be obtained.

[0084]

Experimental example 3

Viscosity was evaluated using each curable resin composition having the formulations shown in Table 3. Results are shown in Table 3.

[0085]

[Viscosity]

The viscosity of each composition was measured using an E type viscometer at a temperature of 25 °C and at the rotation speed of 20 rpm.

[0086]

[Table 3]

Example Nos.	—	Unit	EX. 11	COMP. 2
(A) Component (parts by mass)	Oligomer 1	Parts By Mass		
	Oligomer 2			
	Oligomer 3			
	Oligomer 4		48	48
(B) Component (parts by mass)	M113			
	LA			
	4HBA		10	10
	NOAA		12	12
(C) Component (parts by mass)	Irgacure-184			
	LucirinTPO		0.5	0.5
	Irgacure-819		0.05	0.05
(D) Component (parts by mass)	DOS		30	
	DOA			
(E) Component (parts by mass)	HARITACK F85		20	20
	YS RESIN TR105			
	YS POLYSTAR TH130			
(F) Component (parts by mass)	MT-PE1			
	EHMP			
(G) Component (parts by mass)	GP		0.05	0.05
Workability Test	Viscosity	mPa·s	4000	40000

[0087]

As can be seen from Table 3, the present invention produces advantageous effects. When the dicarboxylic acid diester is not used (Comparative Example 2), the viscosity is increased. The decreased viscosity leads to easier application to the materials to be bonded, and to improved applying workability.

[0088]

The present invention can provide, for example, a composition that maintains adhesiveness on the surface even after curing. Furthermore, the present invention also produces the following effects.

[0089]

Light shielding portions of the icon sheets or touch panels which are the materials to be bonded may be covered with printing or the like in order to hide driving ICs or wiring of the display body or frame sealing agents of the LCDs such that only the display areas can be seen, to improve designability. In the conventional photocurable adhesive composition, adhesive and tackifying force (also referred to as tacking force; but herein referred to as the adhesive and tackifying force) on the surface has tended to decrease as the curing has progressed. Therefore, the method of bonding the materials to each other has been often carried out by applying an adhesive onto one of the materials and then laminating other material to the adhesive-applied material in a state where the adhesive is in an uncured liquid or the adhesive is cured to such an extent that it is not completely cured (also referred to as "semi-cured", and "temporarily cured", and the like), and then irradiating it with ultraviolet light to cure the adhesive. In this case, there has been a problem that the presence of the light shielding portion as stated above may lead to insufficient adhesion because the photocurable adhesive composition below the light shielding portion is not exposed to light and is not cured.

[0090]

The present invention also solves the above problem, and can produce the following effects, for example. According to the present invention, the curable resin composition can be cured by preliminarily curing the adhesive composition applied onto one material before laminating the one material to other material, without affecting the light shielding portion even if it is present in the materials to be bonded. The present invention can provide decreased cure shrinkage and no change in surface accuracy such as dimensional change or warping. The present invention can withstand expansion and contraction of the materials to be bonded, in the reliability test at elevated temperature. The present invention does not cause

problems such as coloration and discoloration after the heat resistance test, and deterioration of strength after the moisture resistance test.

[0091]

The present invention can provide a curable resin composition in which the adhesive on the surfaces of the materials to be bonded can be uniformly cured regardless of the presence or absence of the light shielding portion, even at a position that is not exposed to visible light or ultraviolet light from the front of the material due to the light shielding portion such as printing, by means of preliminary curing the adhesive onto one material by irradiating the adhesive with visible light or ultraviolet light before laminating the one material to other material when laminating the decorative plates or icon sheets used for the display body such as the touch panel to each other, when bonding the transparent substrate to the transparent substrate, or when bonding printed portions to each other. The present invention is capable of curing the curable adhesive resin placed below the light shielding portion and producing an effect of suppressing poor curing of the adhesive.

CLAIMS

1. A composition comprising the following components (P) and (C) to (E):

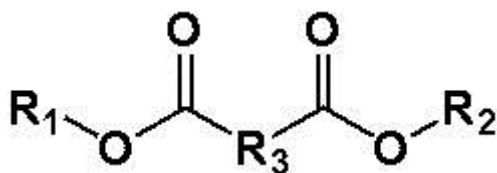
(P) a polymerizable vinyl compound;

(C) a photoinitiator;

(D) a dicarboxylic acid diester; and

(E) a tackifying agent.

2. The composition according to claim 1, wherein the component (D) comprises a dicarboxylic acid diester represented by the formula (1):



Formula (1)

in which R₁ and R₂, that may be the same or different, each represents an alkyl group comprising 1 to 18 carbon atoms, and R₃ represents an alkylene group comprising 1 to 10 carbon atoms.

3. The composition according to claim 1 or 2, wherein the component (D) comprises a sebacic acid diester.
4. The composition according to any one of claims 1 to 3, further comprising (F) a thiol.
5. The composition according to claim 4, wherein the thiol comprises a polythiol.
6. The composition according to any one of claims 1 to 5, further comprising (G) an antioxidant.
7. The composition according to any one of claims 1 to 6, wherein the polymerizable vinyl compound (P) contains (A) a polyfunctional (meth)acrylate and (B) a monofunctional (meth)acrylate.

8. The composition according to claim 7, wherein the polyfunctional (meth)acrylate (A) comprises urethane (meth)acrylate.
9. The composition according to claim 7, wherein the monofunctional (meth)acrylate (B) comprises one or more selected from the group consisting of phenol alkylene oxide-modified (meth)acrylates, alkyl (meth)acrylates, and hydroxyalkyl (meth)acrylates.
10. The composition according to any one of claims 1 to 9, wherein an amount of the component (D) is from 5 to 50 parts by mass per the total 100 parts by mass of the components (P) and (D).
11. The composition according to any one of claims 1 to 10, wherein the tackifying agent (E) comprises one or more selected from the group consisting of fully-hydrogenated rosin resins, aromatic-modified terpene resins, and terpene phenol resins.
12. A curable resin composition comprising the composition according to any one of claims 1 to 11.
13. An adhesive composition comprising the composition according to any one of claims 1 to 11.
14. A cured product of the adhesive composition according to claim 13.
15. A composite in which materials are covered or bonded by the cured product according to claim 14.
16. The composite according to claim 15, wherein the materials comprise one or more selected from the group consisting of triacetyl cellulose, fluorine-based

polymers, polyesters, polycarbonates, polyolefins, glass, and metals.

17. A touch panel laminate in which materials are laminated via the adhesive composition according to claim 13.

18. A liquid crystal panel laminate in which materials are laminated via the adhesive composition according to claim 13.

19. A display comprising the touch panel laminate according to claim 17.

20. A display comprising the liquid crystal panel laminate according to claim 18.

21. An adhesive composition comprising the composition according to any one of claims 1 to 11,

wherein the polymerizable vinyl compound (P) contains (A) at least one polyfunctional (meth)acrylate and (B) at least one monofunctional (meth)acrylate,

wherein the polyfunctional (meth)acrylate (A) comprises urethane (meth)acrylate, and the monofunctional (meth)acrylate (B) comprises one or more selected from the group consisting of phenol alkylene oxide-modified (meth)acrylates, alkyl (meth)acrylates, and hydroxyalkyl (meth)acrylates,

wherein an amount of the polyfunctional (meth)acrylate (A) is from 10 to 90 parts by mass per the total 100 parts by weight of the components (A), (B) and (D),

wherein an amount of the monofunctional (meth)acrylate (B) is from 3 to 80 parts by mass per the total 100 parts by mass of the components (A), (B) and (D),

wherein an amount of the dicarboxylic acid diester (D) is from 1 to 50 parts by mass per the total 100 parts by mass of the components (P) and (D),

wherein the tackifying agent (E) comprises one or more selected from the group consisting of fully-hydrogenated rosin resins, aromatic-modified terpene resins, and terpene phenol resins,

wherein an amount of the tackifying agent (E) is from 1 to 40 parts by mass per the total 100 parts by mass of the components (P) and (D),

wherein the composition further comprises from 0.1 to 10 parts by mass of (F) a polythiol per the total 100 parts by mass of the components (P) and (D), and wherein the composition further comprises (G) an antioxidant.