

DESCRIPTION

RESIN COMPOSITION FOR OPTICAL COMPONENT, AND OPTICAL
5 COMPONENT PRODUCED BY USING THE RESIN COMPOSITION

TECHNICAL FIELD

[0001] The present invention relates to an optical
component resin composition (transparent resin for
10 optical applications) which is advantageous as an
optical material for various optical components such
as an optical lens and a light converging/diverging lens
and an optical component bonding agent which are
required to be highly heat-resistant and highly
15 transparent for transmission of optical signals with
a lower loss. The invention further relates to an
optical component produced by using the resin
composition.

BACKGROUND ART

20 [0002] In recent optical components such as imaging
devices for use in mobile phones and digital cameras,
imaging optical lenses are mounted. Optical glass
materials and transparent plastic materials are
generally used as lens materials. Particularly, with
25 recent increased popularity of mobile phones having an

imaging function, there is a need for producing the optical lenses at lower costs. Therefore, optically transparent polyolefin materials that permit easy designing of the lenses are mainly used as the plastic lens materials. In general, the imaging device is mounted on a printed board by a pin insertion process using a socket or by first mounting an imaging element on the printed board by a solder reflow process and then attaching a lens unit to the imaging element. For mass production at lower costs, it is strongly desirable to mount the imaging device per se on the printed board by the solder reflow process.

[0003] Where the imaging device per se is to be mounted on the printed board by the solder reflow process, however, the plastic lens is subjected to a high temperature environment at a temperature higher than a softening point thereof. This leads to a problem associated with the softening and the dimensional deformation of the plastic lens. To solve this problem, it is contemplated to use a resin composition mainly containing a highly heat-resistant epoxy resin as a material for the optical lens and other optical components. An inprint production method using a heat-resistant photocurable resin, for example, is now put into practical application. In the inprint method,

a shaping mold is pressed against a resin material to form a specific minute pattern or a textured product (e.g., PTL 1).

[0004] With recent trend toward reduction in the thickness of the optical lens and increase in the resolution, there is a demand for a resin material having a higher refractive index. In order to increase the refractive index of the resin composition, it is necessary to use a raw material having a higher refractive index. For example, a material containing a benzene ring in its skeleton is generally known to have a higher refractive index, and is useful for increasing the refractive index of the resin composition. However, the benzene ring-containing material is known to have a lower transparency due to the light absorption of the aromatic ring and suffer from thermal discoloration. In general, the higher refractive index material has a rigid structure and, hence, is mostly solid at an ordinary temperature with a higher melting point. For example, a fluorene skeleton-containing epoxy resin, which is known as a higher refractive index material and studied from various aspects, is solid at the ordinary temperature and has a higher viscosity in a melted state. Therefore, a resin composition containing the fluorene

skeleton-containing epoxy resin in a greater amount to be imparted with a higher refractive index is liable to have a higher viscosity and hence poorer handlability. Similarly, an epoxy resin containing a biphenyl

5 skeleton having a glycidyl group at a p-position for general use is solid at the ordinary temperature with a higher melting point. Therefore, a composition containing such an epoxy resin is liable to have a higher viscosity and hence poorer handlability. To cope with
10 this, a solvent or a liquid epoxy resin is added to the resin composition (PTL 2 and PTL 3).

RELATED ART DOCUMENT

PATENT DOCUMENT

[0005] PTL 1: JP3926380

15 PTL 2: JP-A-2012-129010

PTL 3: JP-A-2011-225773

SUMMARY OF INVENTION

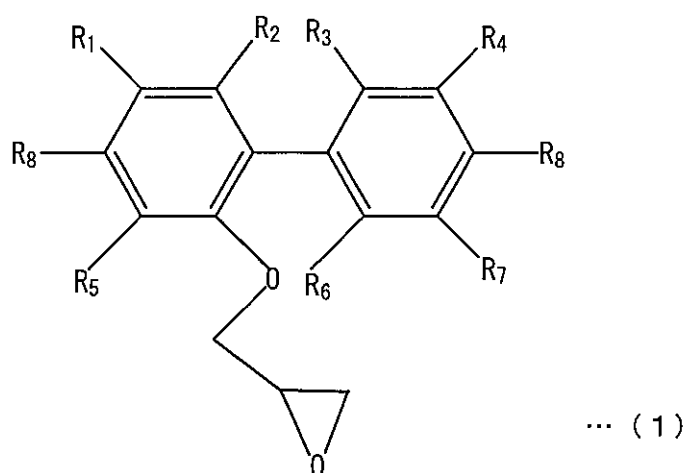
[0006] In the conventional art, the higher refractive index resin problematically has a higher viscosity and
20 hence poorer handlability, and fails to have a higher transparency.

[0007] In view of the foregoing, it is an object of the present invention to provide an optical component resin composition which is imparted with excellent
25 handlability, a higher transparency and excellent heat

resistance by using an epoxy resin having a specific structure and is advantageous as an optical component material with a higher refractive index after curing, and to provide an optical component produced by using the resin composition.

[0008] According to a first aspect of the present invention to achieve the above object, there is provided an optical component resin composition containing:

(A) an epoxy resin having a structure represented by the following general formula (1):



wherein R₁ to R₇, which may be the same or different, are each C_nH_{2n+1} (wherein n is a positive number of 1 to 5), H, a monovalent aromatic ring, an aromatic ring connected via a carbon atom or an oxygen atom, an alcoholic hydroxyl group or a glycidyl ether group, and R₈ is H;

(B) a fluorene epoxy resin; and

(C) an epoxy resin curing agent.

[0009] According to a second aspect of the present invention, there is provided an optical component made of a cured product of the optical component resin composition of the first aspect.

[0010] The inventor of the present invention conducted intensive studies to provide an optical component resin composition having a higher refractive index and a higher heat resistance. As a result, the inventor found that, where the epoxy resin (A) having the above specific structure and having a higher refractive index, a lower melting point and a lower melt viscosity is used in combination with the fluorene epoxy resin (B), the intended object is achieved to provide a resin

composition which can provide a cured product having a higher transparency and a refractive index of, for example, not lower than 1.57 after curing, and attained the present invention. Further, the inventive optical component resin composition can be used on a solvent-free basis, so that the cured product of the resin composition is free from voids which may otherwise be generated in the product during the molding and is advantageous for use as an optical component.

[0011] Thus, the present invention provides the

optical component resin composition containing the

specific epoxy resin (A), the fluorene epoxy resin (B) and the epoxy resin curing agent (C). Since the optical component resin composition can be cured on a transparent substrate such as a glass plate, it is possible to produce a high quality hybrid lens by combining a cured product of the resin composition with the transparent substrate. Further, the optical component resin composition may be used alone to be cured, for example, for production of a highly heat-resistant plastic lens. Thus, a highly reliable optical component can be produced by using the inventive optical component resin composition as a lens formation material or other optical component formation material or as a photocurable adhesive agent for bonding an optical component. Therefore, the inventive optical component resin composition is useful.

[0012] Where the specific epoxy resin (A) is present in a proportion of 10 to 75 wt.% based on the weight of a resin component of the optical component resin composition and the fluorene epoxy resin (B) is present in a proportion of 10 to 60 wt.% based on the weight of the resin component of the optical component resin composition, the resin composition has a higher refractive index and is excellent in heat resistance.

[0013] Where the optical component resin composition

further contains 5 to 40 wt.% of an oxetane compound based on the weight of the resin component thereof, the resin composition is more excellent in curability.

DESCRIPTION OF EMBODIMENTS

5 [0014] Next, an embodiment of the present invention will be described in detail. However, it should be understood that the present invention be not limited to this embodiment.

[0015] <<Resin Composition for Optical Component>>

10 An optical component resin composition according to the present invention (hereinafter sometimes referred to simply as "resin composition") is prepared by using: (A) a specific epoxy resin; (B) a fluorene epoxy resin; and (C) an epoxy resin curing
15 agent. As described above, the optical component resin composition according to the present invention can be used on a solvent-free basis.

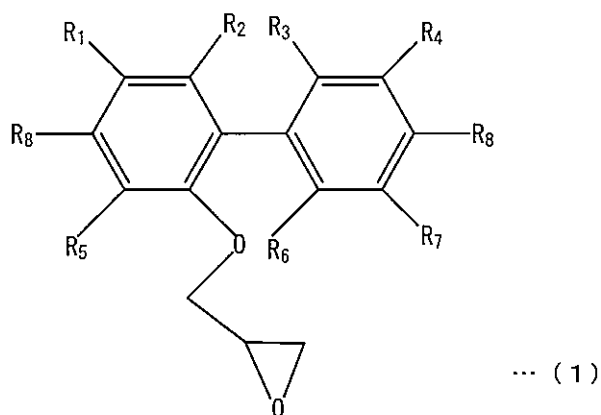
The respective ingredients will be described in turn below.

20 [0016] <Specific Epoxy Resin (A)>

The specific epoxy resin (A) is an epoxy resin having a specific biphenyl skeleton and represented by the following general formula (1):

[0017]

25



5

wherein R_1 to R_7 , which may be the same or different, are each C_nH_{2n+1} (wherein n is a positive number of 1 to 5), H, a monovalent aromatic ring, an aromatic ring connected via a carbon atom or an oxygen atom, an
 10 alcoholic hydroxyl group or a glycidyl ether group, and R_8 is H.

[0018] In the formula (1), R_1 to R_7 are particularly preferably all hydrogen.

[0019] The specific epoxy resin (A) preferably has an
 15 epoxy equivalent of 100 to 500.

[0020] A specific example of the specific epoxy resin (A) is OPP-G available from Sanko Co., Ltd.

[0021] The proportion of the specific epoxy resin (A) is preferably 10 to 75 wt.%, particularly preferably
 20 10 to 70 wt.%, based on the weight of the overall resin component of the optical component resin composition. If the proportion of the specific epoxy resin (A) is excessively small, the resin composition will fail to have a lower viscosity and a higher refractive index
 25 as intended. If the proportion of the specific epoxy

resin (A) is excessively great, the resin composition is liable to be more brittle.

[0022] <Fluorene Epoxy Resin (B)>

The fluorene epoxy resin (B) may be properly selected from various fluorene epoxy resins having a fluorene skeleton in consideration of the desired viscosity, refractive index and photocurability.

Specific examples of the fluorene epoxy resin include PG-100 and EG-200 available from Osaka Gas Chemicals Co., Ltd. These may be used alone or in combination.

[0023] The fluorene epoxy resin preferably has an epoxy equivalent of 200 to 400.

[0024] The proportion of the fluorene epoxy resin (B) is preferably 10 to 60 wt.%, particularly preferably 10 to 50 wt.%, based on the weight of the overall resin component of the optical component resin composition. If the proportion of the fluorene epoxy resin (B) is excessively great, the resin composition is liable to have a higher viscosity and hence poorer handlability.

If the proportion of the fluorene epoxy resin is excessively small, it will be difficult to impart the cured product of the resin composition with a higher refractive index and a higher transparency.

[0025] <Epoxy Resin Curing Agent (C)>

A photopolymerization initiator, a heat-acid

generator, an imidazole curing catalyst, a curing agent that allows an epoxy resin polymerization reaction to proceed or a curing assisting agent is used as the epoxy resin curing agent (C) according to the use purpose of the resin composition. Examples of the photopolymerization initiator include onium salts, such as containing an antimony or phosphorus anion moiety and a sulfonium, iodonium or phosphonium cation moiety, that are capable of initiating cationic polymerization. Specific examples of the photopolymerization initiator include aromatic sulfonium salts, aromatic iodonium salts, aromatic phosphonium salts and aromatic sulfoxonium salts, among which the aromatic sulfonium salts are preferred for photocurability.

[0026] The proportion of the epoxy resin curing agent (C) to be used as the photopolymerization initiator, for example, is preferably set to 0.05 to 5 parts by weight, particularly preferably 0.1 to 4 parts by weight, based on 100 parts by weight of the resin component of the optical component resin composition. If the proportion of the epoxy resin curing agent (C) is excessively small, the resin composition is liable to have poorer curability. If the proportion of the epoxy resin curing agent (C) is excessively great, the resin

composition is improved in curability, but the cured product of the resin composition is liable to have poorer transparency.

[0027] The optical component resin composition

5 according to the present invention preferably contains an oxetane compound in addition to the above ingredients (A) to (C) for improvement of the curability. Usable as the oxetane compound are oxetane compounds having one or more oxetane rings in each molecule thereof.

10 Examples of the oxetane compound include

1,4-bis{[(3-ethyl-3-oxetanyl)methoxy]methyl}benzene,
di[2-(3-oxetanyl)butyl]ether,

3-ethyl-3-hydroxymethyloxetane, xylylenebisoxetane,
3-ethyl-3-{[(3-ethyloxetan-3-yl)methoxy]methyl}oxetane,

15 3-ethyl-3-(phenoxymethyl)oxetane,

4,4'-bis[(3-ethyl-3-oxetanyl)methoxymethyl]biphenyl,

1,4-bis[(3-ethyloxetan-3-yl)methoxy]benzene,

1,3-bis[(3-ethyloxetan-3-yl)methoxy]benzene,

1,2-bis[(3-ethyloxetan-3-yl)methoxy]benzene,

20 4,4'-bis[(3-ethyloxetan-3-yl)methoxy]biphenyl,

2,2'-bis[(3-ethyl-3-oxetanyl)methoxy]biphenyl,

3,3',5,5'-tetramethyl-[4,4'-bis(3-ethyloxetan-3-yl)
methoxy]biphenyl,

2,7-bis[(3-ethyloxetan-3-yl)methoxy]naphthalene,

25 1,6-bis[(3-ethyloxetan-3-yl)methoxy]-2,2,3,3,4,4,5,5-

octafluorohexane,

3(4),8(9)-bis[(1-ethyl-3-oxetanyl)methoxy]methyl-tricyclo
[5.2.1.2.6]decane,

1,2-bis{[2-(1-ethyl-3-oxetanyl)methoxy]ethylthio}ethane,

5 4,4'-bis[(1-ethyl-3-oxetanyl)methyl]thiodibenzene
thioether,

2,3-bis[(3-ethyloxetan-3-yl)methoxymethyl]norbornane,

2-ethyl-2-[(3-ethyloxetan-3-yl)methoxymethyl]-1,3-o-
bis[(1-ethyl-3-oxetanyl)methyl]-propane-1,3-diol,

10 2,2-dimethyl-1,3-o-bis[(3-ethyloxetan-3-yl)methyl]-
propane-1,3-diol,

2-butyl-2-ethyl-1,3-o-bis[(3-ethyloxetan-3-yl)methyl]-
propane-1,3-diol,

1,4-o-bis[(3-ethyloxetan-3-yl)methyl]-butane-1,4-diol,

15 and 2,4,6-o-tris[(3-ethyloxetan-3-yl)methyl]cyanurate.

These may be used alone or in combination.

[0028] The proportion of the oxetane compound is
preferably set to 5 to 40 wt.% based on the weight of
the overall resin component of the optical component
20 resin composition. If the proportion of the oxetane
compound is excessively great, it will be difficult to
provide a higher refractive index as desired.

[0029] The inventive optical component resin
composition may contain a photo-sensitizer and an acid
25 proliferating agent, for example, for improvement of

the curability in addition to the ingredients (A) to (C) and the oxetane compound. For easy adjustment of the refractive index and improvement of the handlability, the optical component resin composition may additionally contain a monofunctional or difunctional epoxy resin other than the ingredients (A) and (B). Examples of the additional epoxy resin include an alicyclic epoxy resin and a hydrogenated bisphenol epoxy resin. Particularly for a higher refractive index, a bisphenol-A epoxy resin and a bisphenol-F epoxy resin are preferably used.

[0030] Where a cured product of the resin composition is to be formed on a substrate such as a glass substrate, a silane or titanium coupling agent may be added to the resin composition to increase the adhesiveness of the resin composition to the substrate. As required, the resin composition may further contain additives such as a plasticizing agent such as a synthetic rubber or a silicone compound, an antioxidant, a defoaming agent, a pigment, a dye and an inorganic filler. Addition of an organic solvent or the like for the improvement of the handlability is not preferred, because voids are liable to occur in the cured product during the molding or the characteristic properties are liable to be impaired. Therefore, the resin composition is

preferably designed on the solvent-free basis.

[0031] The inventive optical component resin composition may be prepared by heat-melting and mixing the aforementioned ingredients (A) to (C), the oxetane component and, as required, any of the aforementioned additives in predetermined proportions.

[0032] The inventive optical component resin composition has a viscosity of 0.5 to 32 Pa·s (more preferably 0.5 to 10 Pa·s) at 25°C environment and, therefore, is excellent in handlability and the like. Since the optical component resin composition is imparted with the aforementioned viscosity without the use of the organic solvent, the resin composition is free from the problem associated with the voids which may otherwise occur in the cured product of the resin composition when the organic solvent is evaporated during a photo-curing/molding process. The viscosity of the optical component resin composition is measured at a temperature of 25°C, for example, with the use of a standard rotor (1°34' × R24) by means of a E-80 Model viscometer (RE-80U) available from Toki Sangyo Co., Ltd.

[0033] The inventive optical component resin composition is used, for example, in the following manner. The resin composition is applied on a

transparent substrate such as of glass, and a predetermined shaping mold is pressed against the resin composition to be thereby filled with the resin composition. In turn, the resin composition is irradiated with light to be thereby cured, and then the shaping mold is removed. Thus, a cured product (molded product) of the resin composition combined with the transparent substrate is provided. Alternatively, the resin composition may be poured in a light-transmissive transparent mold, and photo-cured. A hybrid lens, for example, is produced from the inventive optical component resin composition by the aforementioned production method. The inventive optical component resin composition may be cured alone in the shaping mold to provide an optical component such as an optical lens. Further, the cured product obtained by the light irradiation may be heat-treated at a predetermined temperature as required. The molded product (cured product) thus obtained may be demolded from the shaping mold and further heat-treated at a predetermined temperature as required. The heat treatment enhances the heat stability of the cured product. Particularly in the case of the cured product combined with the transparent substrate, the heat treatment enhances the adhesion between the substrate and the cured resin

product.

[0034] For example, a UV lamp, a single-band lamp of a predetermined wavelength or the like may be used as a device for the light irradiation. Exemplary light sources include a low pressure mercury lamp, a high pressure mercury lamp, an ultrahigh pressure mercury lamp and a xenon lamp. The irradiation dose is preferably 2000 to 200000 mJ/cm². If the irradiation dose is less than the aforementioned range, it will be impossible to provide an intended cured product configuration on the substrate due to insufficient curing. If the irradiation dose is greater than the aforementioned range, on the other hand, photo-degradation is liable to occur due to excessive light irradiation, leading to discoloration by the subsequent heat treatment. Conditions for the heat treatment to be performed after the light irradiation are preferably a treatment temperature of 80°C to 170°C and a treatment period of about 1 hour.

[0035] The inventive optical component resin composition may be formed into a sheet without the use of the shaping mold.

[0036] The inventive optical component resin composition prepared in the aforementioned manner is effective in that the cured product thereof is less

susceptible to thermal discoloration during a solder reflow process and is imparted with stable mechanical properties against thermal stress. Therefore, the inventive cured product can be advantageously used when a component incorporating the inventive cured product is mounted by the solder reflow process in a single process step.

[0037] The inventive optical component resin composition is usable as a material (optical component material) for an optical lens and other optical component, which are to be produced by the aforementioned production method. Further, the inventive optical component resin composition is usable as a photo-curable adhesive agent for bonding an optical waveguide and other optical component.

EXAMPLES

[0038] Next, the present invention will be described by way of examples thereof. However, it should be understood that the present invention be not limited to these examples. In the examples, the term "part(s)" means "part(s) by weight" unless otherwise specified.

[0039] Prior to preparation of resin compositions of Examples, the following epoxy resins, oxetane resin, photoacid generator and other additives were prepared.

[0040] <Specific Epoxy Resins (A)>

(a-1) An epoxy resin (having an epoxy equivalent of 226 g/eq) represented by the above formula (1), wherein R_1 to R_8 are all H.

(a-2) An epoxy resin (having an epoxy equivalent of 113 g/eq) represented by the above formula (1), wherein R_3 is a glycidyl ether group and R_1 to R_8 excluding R_3 are H.

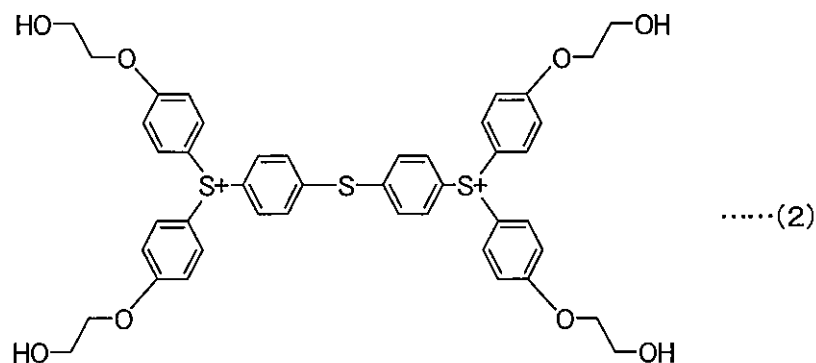
[0041] <Fluorene Epoxy Resin (B)>

(b-1) A difunctional fluorene epoxy resin (having an epoxy equivalent of 259 g/eq and a refractive index of 1.64).

[0042] <Epoxy Resin Curing Agent (Photopolymerization Initiator) (C)>

(c-1) A triaryl sulfonium salt photopolymerization initiator (photoacid generator) containing an anion moiety of Sb_6^- and a cation moiety represented by the following structural formula (2) (in the form of 50 wt.% propylene carbonate solution).

[0043]



[0044] <Other Additives>

(d-1) A bisphenol-A epoxy resin (which was solid (at
5 25°C), and had an epoxy equivalent of 175 g/eq, a
softening point of 45°C and a refractive index of 1.57)

(d-2) A bisphenol-F epoxy resin (which had an epoxy
equivalent of 162 g/eq, a viscosity of 2000 mPa·s (at
25°C) and a refractive index of 1.57)

10 (d-3) 3-Ethyl-3-(phenoxyethyl)oxetane

(d-4) A silane coupling agent

3-glycidoxypropylmethyldiethoxysilane

(d-5)

9,10-dihydro-9-oxa-10-phosphaphenanthrene-10-oxide

15 [0045] <Biphenyl Epoxy Resin other than Specific Epoxy
Resin (A)>

(YX4000) A biphenyl epoxy resin (available from
Mitsubishi Chemical Corporation)

(YX4000H) A biphenyl epoxy resin (available from
20 Mitsubishi Chemical Corporation)

[0046] [Examples 1 to 7 and Comparative Examples 1 to
3]

Optical component resin compositions were
prepared by blending the aforementioned ingredients in
25 proportions as shown below in Tables 1 and 2, and then

heat-melting and mixing the blended ingredients.

[0047] The optical component resin compositions of Examples and Comparative Examples thus prepared were evaluated for characteristic properties based on the following criteria. The results are also shown below in Tables 1 and 2.

[0048] [Refractive Index]

The optical component resin compositions (liquid resins) were each poured in a transparent shaping mold having a size of $1 \times 1.5 \times 0.5$ cm, and irradiated with ultraviolet (UV) radiation at 10,000 mJ/cm² to be thereby cured. Then, the resulting product was demolded from the mold, and heat-treated at 150°C for 1 hour. The surface of the resulting molded product was polished by means of a grinder, and then the refractive index of the molded product was measured at 25°C environment by means of a refractometer (available from Atago Co., Ltd.) As a result, an optical component resin composition having a refractive index of lower than 1.57 was rated as unacceptable (x), and an optical component resin composition having a refractive index of not lower than 1.57 was rated as acceptable (o).

[0049] [Viscosity at 25°C]

The viscosity of each of the optical component resin compositions was measured at 25°C environment with

the use of a standard rotor (1°34' × R24) by means of a E-80 Model viscometer (RE-80U) available from Toki Sangyo Co., Ltd. As a result, an optical component resin composition having a viscosity of not lower than 35 Pa·s was rated as unacceptable (×), and an optical component resin composition having a viscosity of not lower than 10 Pa·s and lower than 35 Pa·s was rated as acceptable (Δ). Further, an optical component resin composition having a viscosity of lower than 10 Pa·s was rated as excellent (○).

[0050] [Thermal discoloration resistance (transparency)]

The optical component resin compositions were each formed into a film having a thickness of 300 μm on a PET film (DIAFOIL MRF-50 available from Mitsubishi Chemical Polyester Film Company) treated with a silicone release agent. The film was primarily cured by irradiation with light (at an irradiation dose of 10,000 mJ/cm²), and then the film was heat-treated at 150°C for 1 hour. Thus, a cured product (test piece) was produced. The test piece was transported through a reflow furnace at 260°C for 10 seconds. The light transmittance of the test piece was measured at a wavelength of 400 nm by means of a spectrophotometer (available from JASCO Corporation), and checked. As a result, a test piece having a light transmittance of

lower than 60 % was rated as unacceptable (x), and a test piece having a light transmittance of not lower than 60 % and lower than 70 % was rated as acceptable (Δ). Further, a test piece having a light

5 transmittance of not less than 70 % was rated as excellent (o).

[0051] [Curability]

{ When a test sample was prepared for the measurement for the thermal discoloration resistance
10 (transparency), the surface tackiness of the test sample was checked by visual inspection and finger touch after the light irradiation. As a result, a test sample uncured in a liquid state was rated as unacceptable (x), and a test sample having a slightly tacky surface was
15 rated as acceptable (Δ). Further, a test sample cured without tackiness was rated as excellent (o).

[0052]

Table 1

(parts)

		Example						
		1	2	3	4	5	6	7
Epoxy resin (A)	a-1	10	70	75	65	30	60	50
	a-2	-	5	-	-	-	-	-
Fluorene epoxy resin (B) b-1		10	25	25	30	30	40	50
Other additives	d-1	80	-	-	-	-	-	-
	d-2	-	-	-	-	-	-	-
	d-3	-	-	-	5	40	-	-
	d-4	1	1	1	1	1	1	1
	d-5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Photopolymerization initiator (C) c-1		1	1	1	1	1	1	1
Biphenyl epoxy resin (YX4000)		-	-	-	-	-	-	-
Biphenyl epoxy resin (YX4000H)		-	-	-	-	-	-	-
Solid refractive index		1.60	1.61	1.62	1.63	1.60	1.64	1.65
Evaluation		o	o	o	o	o	o	o
Viscosity (Pa·s) at 25°C		9.0	6.8	2.0	3.0	3.4	8.7	32.0
Evaluation		o	o	o	o	o	o	Δ
Thermal discoloration resistance (%)		72	70	73	74	71	71	70
Evaluation		o	o	o	o	o	o	o
Curability		o	Δ	Δ	o	o	o	o

Mirror English Translation

PCT/JP2015/57790

Client's ref: F6117SG; Our ref: 1449-SG

[0053]

Table 2

(parts)

		Comparative Example		
		1	2	3
Epoxy resin (A)	a-1	-	-	-
	a-2	-	-	-
Fluorene epoxy resin (B) b-1		50	50	25
Other additives	d-1	-	-	-
	d-2	-	-	75
	d-3	-	-	-
	d-4	1	1	1
	d-5	0.5	0.5	0.5
Photopolymerization initiator (C) c-1		1	1	1
Biphenyl epoxy resin (YX4000)		50	-	-
Biphenyl epoxy resin (YX4000H)		-	50	-
Solid refractive index		1.62	1.62	1.60
Evaluation		o	o	o
Viscosity (Pa·s) at 25°C		>100	>100	10.2
Evaluation		x	x	Δ
Thermal discoloration resistance (%)		25	24	30
Evaluation		x	x	x
Curability		o	o	o

Mirror English Translation

PCT/JP2015/57790

Client's ref: F6117SG; Our ref: 1449-SG

[0054] The above results indicate that the optical component resin compositions of Examples containing the specific epoxy resin and the fluorene epoxy resin as the epoxy resin component each had a higher refractive index, a lower viscosity, an excellent transparency and practically acceptable curability. Therefore, an optical component (e.g., an optical lens) having a higher refractive index and a higher thermal discoloration resistance can be provided by using any of the optical component resin compositions of Examples. Further, the optical component produced by using any of the resin compositions of Examples is free from discoloration even with application of heat during the solder reflow process, and has stable mechanical properties against thermal stress. Therefore, the optical component is advantageously used when an imaging device is mounted by the solder reflow process in a single process step.

[0055] In contrast, the optical component resin compositions of Comparative Examples 1 and 2 prepared by using an epoxy resin having a glycidyl group at a p-position unlike the epoxy resin represented by the general formula (1) each had a very high viscosity and a lower light transmittance, failing to provide an intended cured product. Further, the optical

component resin composition of Comparative Example 3 prepared without the use of the epoxy resin having the structure represented by the general formula (1) had a lower transparency and, therefore, was apparently unsuitable as an optical component material.

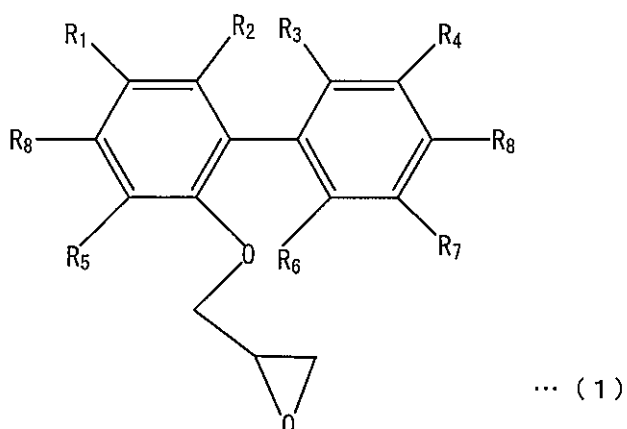
[0056] While specific forms of the embodiment of the present invention have been shown in the aforementioned inventive examples, the inventive examples are merely illustrative of the invention but not limitative of the invention. It is contemplated that various modifications apparent to those skilled in the art could be made within the scope of the invention.

[0057] The optical component resin composition according to the present invention can provide a three-dimensional product (cured product) having a higher transparency and a higher refractive index. Therefore, the inventive resin composition is useful as a material for forming an optical component such as an optical lens (optical component material) and as a photocurable adhesive agent for bonding optical components and the like in optical applications. Further, an optical component produced by using the inventive optical component resin composition is highly reliable, and is usable as an optical lens and the like (optical device).

CLAIMS

1. An optical component resin composition comprising:

(A) an epoxy resin having a structure represented by the following general formula (1):



wherein R_1 to R_7 , which may be the same or different, are each C_nH_{2n+1} (wherein n is a positive number of 1 to 5), H, a monovalent aromatic ring, an aromatic ring connected via a carbon atom or an oxygen atom, an alcoholic hydroxyl group or a glycidyl ether group, and R_8 is H;

(B) a fluorene epoxy resin; and

(C) an epoxy resin curing agent.

2. The optical component resin composition according to claim 1,

wherein the epoxy resin (A) is present in a proportion of 10 to 75 wt.% based on the weight of a

resin component of the optical component resin composition,

wherein the fluorene epoxy resin (B) is present in a proportion of 10 to 60 wt.% based on the weight of the resin component of the optical component resin composition.

3. The optical component resin composition according to claim 1 or 2, further comprising 5 to 40 wt.% of an oxetane compound based on the weight of the resin component thereof.

4. An optical component comprising a cured product of the optical component resin composition according to any one of claims 1 to 3.