

SPECIFICATION

TITLE OF INVENTION: RESIN COMPOSITION FOR LENS, CURED SUBSTANCE
FOR LENS, AND LENS

5

TECHNICAL FIELD

[0001]

The present invention relates to a resin composition for a
lens, a cured substance for a lens, and a lens.

10

BACKGROUND ART

[0002]

At present, a camera is mounted on a large number of
electronic instruments such as a smartphone, a tablet terminal,
15 and a laptop. In addition, along with the miniaturization and
high performance of these instruments, the miniaturization and
high performance of a lens of a camera to be mounted on the
instruments are also strongly desired.

[0003]

20 It has been known that a silicone resin or an acrylic resin
is used as a material for a lens of a camera to be mounted on
these electronic instruments. In addition, it is also known
that an epoxy resin is used as a material for the lens.
Examples of such a technique include those described in Patent
25 Documents 1 to 3.

[0004]

Patent Document 1 discloses a process including: 1) heating

a mold having a mold cavity in a temperature range of 100°C to 200°C; 2) supplying a certain amount of a silicone composition including a mold release agent to an assembled product, the composition having a viscosity range of 50 cps to 3,000 cps at an operation temperature of the process, and preventing the silicone encapsulating agent composition from flowing out and back from the assembled product; 3) injecting the silicone composition from the assembled product into the mold cavity through a gate, in which the mold cavity has a top and a bottom, a vent is positioned at the top of the mold cavity, the vent has a width of 0.1 mm to 1 mm and a depth of 0.0001 mm to 0.001 mm, the gate is positioned at the bottom of the mold cavity, and the injection is carried out for up to 5 seconds at a pressure range of 1,000 psi to 10,000 psi; 4) maintaining the silicone composition for a sufficient amount of time to prevent the silicone composition from flowing out from the mold cavity at 1,000 psi to 10,000 psi; and 5) curing a product obtained in step 4).

[0005]

In addition, Patent Document 2 discloses an active energy ray-curable resin composition for a Fresnel lens, which contains, as essential components, an epoxy (meth)acrylate (a) having equal to or more than two (meth)acryloyl groups obtained by a reaction of an epoxy resin having a cyclic structure and an epoxy equivalent of equal to or more than 450 g/eq and (meth)acrylic acid, a trifunctional (meth)acrylate (b) having a specific structure, a (meth)acrylate (c) of an aliphatic

polyhydric alcohol having a propylene oxide structure and equal to or more than two hydroxyl groups and having a molecular weight of equal to or less than 700, and a monofunctional (meth)acrylate (d) having a cyclic structure, in order to obtain
5 a Fresnel lens sheet having excellent adhesion to a plastic substrate, being less likely to cause chipping or cracking due to an external force while maintaining a high modulus of elasticity, and exhibiting an excellent shape retention in a wide temperature range, and an active energy ray-curable resin
10 composition for a Fresnel lens sheet using the active energy ray-curable resin composition for a Fresnel lens.

[0006]

In addition, Patent Document 3 discloses a curable composition for a lens, which contains at least an alicyclic
15 epoxy compound (A) having a specific structure, a cationic polymerization initiator (B), and a polysiloxane (C) having a specific structure, and contains 0.01% to 5% by weight of the polysiloxane (C) with respect to the total amount (100% by weight) of the curable composition, in order to provide a
20 curable composition with which a lens having excellent transfer accuracy of a mold and excellent heat resistance and optical characteristics can be formed.

RELATED DOCUMENTS

25 PATENT DOCUMENTS

[0007]

Patent Document 1: PCT Japanese Translation Patent

Publication No. 2008-545553

Patent Document 2: Japanese Unexamined Patent Publication
No. 2003-131004

Patent Document 3: Japanese Unexamined Patent Publication
5 No. 2019-189874

SUMMARY OF THE INVENTION

TECHNICAL PROBLEM

[0008]

10 In lens materials in the related art, there is room for improvement in terms of achieving various characteristics required for lenses in a balanced manner, such as optical characteristics and heat resistance.

[0009]

15 An object of the present invention is to provide a resin composition for a lens, which is capable of forming a cured substance for a lens having an improved performance balance of a high refractive index, a high light transmittance, high heat resistance, and high bleed-out resistance.

20 In addition, another object of the present invention is to provide a cured substance for a lens and a lens in which a performance balance of a high refractive index, a high light transmittance, high heat resistance, and high bleed-out resistance is improved.

25 SOLUTION TO PROBLEM

[0010]

The inventors of the present invention carried out diligent

studies in order to achieve the above-described objects. As a result, it has been found that the above-described problems can be solved by using a specific photocationic polymerization initiator, an epoxy compound, and a specific stabilizer in combination, and thus the present invention has been completed.

[0011]

That is, according to the present invention, a resin composition for a lens, a cured substance for a lens, and a lens are provided as shown below.

10 [0012]

[1]

A resin composition for a lens including:

a photocationic polymerization initiator (X) containing a salt formed of an anion represented by General Formula (1) and a cation;

15

an epoxy compound (Y) containing equal to or more than two epoxy groups in a molecule; and

a stabilizer having a base dissociation constant pK_b of equal to or more than 6.0, which is measured according to

20 <Method for measuring base dissociation index pK_b >,

<Method for measuring base dissociation index pK_b >

0.1 g of a stabilizer is dissolved in 100 g of an 80% by mass methanol-containing aqueous solution, and the solution is measured with a pH meter while being titrated with a 3 N-HCl aqueous solution to obtain a pH titration curve, and the pK_b value is calculated by a graphical method using the obtained pH titration curve.

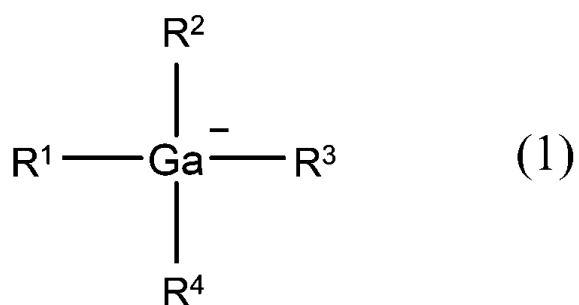
25

[2]

The resin composition for a lens according to [1],

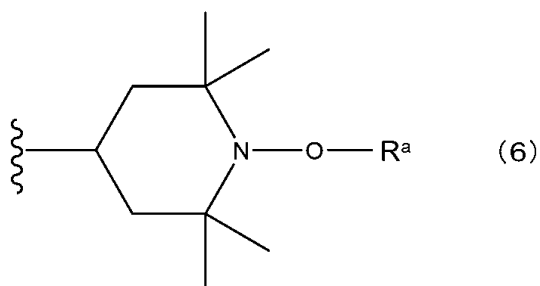
in which the stabilizer includes a stabilizer including a partial structure represented by one or equal to or more than two selected from the group consisting of a partial structure represented by General Formula (6) and a partial structure represented by General Formula (7),

[chem. 1]



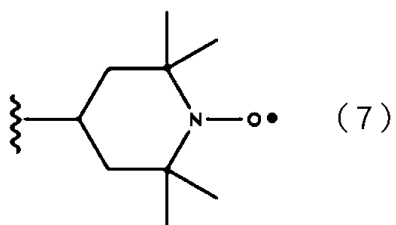
(in General Formula (1), R¹ to R⁴ each independently represent an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms,

[chem. 2]



(in General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms),

[chem. 3]



(in General Formula (7), $O\cdot$ represents an oxyl group).

[3]

The resin composition for a lens according to [1] or [2],
 5 in which the base dissociation constant pK_b of the
 stabilizer is equal to or less than 12.0.

[4]

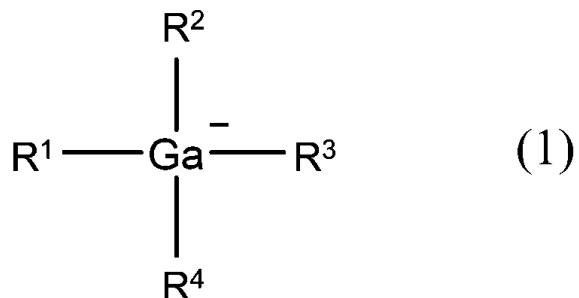
A resin composition for a lens including:

a photocationic polymerization initiator (X) containing a
 10 salt formed of an anion represented by General Formula (1) and a
 cation;

an epoxy compound (Y) containing equal to or more than two
 epoxy groups in a molecule; and

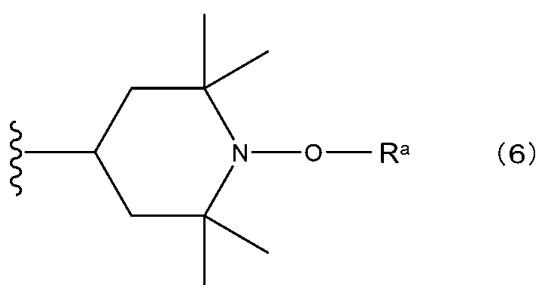
a stabilizer including one or equal to or more than two
 15 kinds of partial structures selected from the group consisting
 of a partial structure represented by General Formula (6) and a
 partial structure represented by General Formula (7),

[chem. 4]



(in General Formula (1), R^1 to R^4 each independently represent an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms,

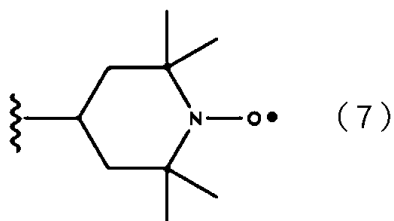
[chem. 5]



5

(in General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms),

[chem. 6]



10

(in General Formula (7), $O\cdot$ represents an oxyl group).

[5]

The resin composition for a lens according to any one of [1] to [4],

15 in which a content of the stabilizer is equal to or more than 0.01 parts by mass and equal to or less than 5.0 parts by mass with respect to 100 parts by mass of the epoxy compound (Y).

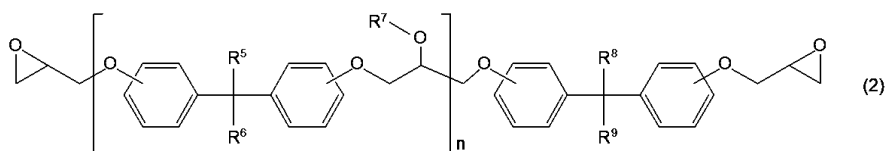
[6]

20 The resin composition for a lens according to any one of

[1] to [5],

in which the epoxy compound (Y) is represented by General Formula (2),

[chem. 7]



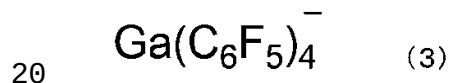
(in General Formula (2), R⁵, R⁶, R⁸, and R⁹ each independently represent a hydrogen atom, an alkyl group having 1 to 4 carbon atoms, or a trifluoromethyl group, R⁷'s each independently represent a hydrogen atom or a glycidyl group, and
10 n is an average repetition number, where n represents a real number in a range of 0 to 30).

[7]

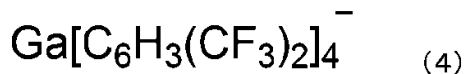
The resin composition for a lens according to any one of [1] to [6],

15 in which the photocationic polymerization initiator (X) includes, as an anion, at least one selected from an anion represented by Formula (3) or an anion represented by Formula (4).

[chem. 8]



[chem. 9]



[8]

The resin composition for a lens according to any one of [1] to [7],

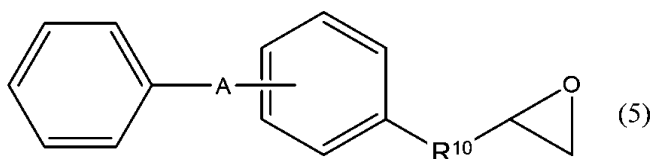
in which the photocationic polymerization initiator (X) contains a sulfonium ion as the cation.

5 [9]

The resin composition for a lens according to any one of [1] to [8], further including:

a monofunctional epoxy compound (Z) represented by General Formula (5),

10 [chem. 10]



(in General Formula (5), A is selected from a single bond, an oxygen atom, and a sulfur atom, R^{10} is an alkylene having 1 to 8 carbon atoms, and any methylene group may be substituted with an oxygen atom).

[10]

The resin composition for a lens according to [9],

in which the monofunctional epoxy compound (Z) contains o-phenylphenol glycidyl ether.

20 [11]

The resin composition for a lens according to any one of [1] to [10], further including:

an oxetane compound (W).

[12]

25 The resin composition for a lens according to [11],

in which the oxetane compound (W) contains a biphenyl type oxetane compound.

[13]

The resin composition for a lens according to any one of
5 [1] to [12],

in which in a case where the resin composition for a lens is subjected to a measurement with an E-type viscometer under conditions of a temperature of 25°C and a rotation speed of 2.5 rpm, a viscosity of the resin composition for a lens is equal to
10 or more than 100 mPa·s and equal to or less than 5,000 mPa·s.

[14]

The resin composition for a lens according to any one of [1] to [13],

in which a refractive index of a cured substance obtained
15 by applying the resin composition for a lens over a glass substrate to have a thickness of 250 μm, subjecting the applied composition to UV exposure under conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the composition
20 under a nitrogen atmosphere at 120°C for 30 minutes is equal to or more than 1.55.

[15]

The resin composition for a lens according to any one of [1] to [14],

25 in which a light transmittance in a thickness direction of a cured substance obtained by applying the resin composition for a lens over a glass substrate to have a thickness of 250 μm,

subjecting the applied composition to UV exposure under conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the composition in a nitrogen atmosphere at 120°C for 30 minutes is equal to or more than 70%, which is measured under the following (Measurement conditions) using an ultraviolet-visible-near infrared spectrophotometer,

(Measurement conditions)

measurement method: transmission method,

10 measurement wavelength: 400 nm,

reference: atmosphere,

detector: integrating sphere/photomultiplier tube (200 nm to 850 nm),

integrating sphere: PbS (850 nm to 2,600 nm).

15 [16]

The resin composition for a lens according to any one of [1] to [15],

in which a light transmittance in a thickness direction of a cured substance obtained by applying the resin composition for

20 a lens over a glass substrate to have a thickness of 250 μm,

subjecting the applied composition to UV exposure under conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the composition in a nitrogen atmosphere at 120°C

25 for 30 minutes is equal to or more than 70%, which is measured under the following (Measurement conditions) after the following (heat resistance test) using an ultraviolet-visible-near

infrared spectrophotometer,

(Measurement conditions)

Measurement method: transmission method,

Measurement wavelength: 400 nm,

5 Reference: atmosphere,

Detector: integrating sphere/photomultiplier tube (200 nm
to 850 nm),

Integrating sphere: PbS (850 nm to 2,600 nm),

(Heat resistance test)

10 the cured substance is heated in an oven set at 125°C for
168 hours in an air atmosphere.

[17]

The resin composition for a lens according to any one of
[1] to [16],

15 in which the resin composition for a lens is used for a
wafer-level lens.

[18]

A cured substance for a lens, which is obtained by curing
the resin composition for a lens according to any one of [1] to

20 [17].

[19]

A lens including:

the cured substance for a lens according to [18].

25 ADVANTAGEOUS EFFECTS OF INVENTION

[0013]

The resin composition for a lens according to the

embodiment of the present invention has the above-described configuration, and thus it is possible to form a cured substance having an improved performance balance of a high refractive index, a high light transmittance, high heat resistance, and
5 high bleed-out resistance.

In addition, since the cured substance for a lens according to the embodiment of the present invention is obtained by curing the above-described resin composition for a lens, the performance balance of high refractive index, high light
10 transmittance, high heat resistance, and high bleed-out resistance is improved.

Furthermore, since the lens according to the embodiment of the present invention includes the above-described cured substance for a lens, the performance balance of high refractive
15 index, high light transmittance, high heat resistance, and high bleed-out resistance is improved.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014]

20 [FIG. 1] A plan view showing an example of a configuration of a wafer-level lens array having a plurality of wafer-level lenses.

DESCRIPTION OF EMBODIMENTS

25 [0015]

Hereinafter, the present invention will be described based on the embodiments.

In the present embodiments, unless otherwise specified, "A to B" that indicates a range of numerical values indicates "equal to or larger than A and equal to or smaller than B".

In the present embodiment, unless otherwise specified, a
5 case where a group such as an alkyl group "has a substituent" means a case where a hydrogen atom present in the structure of the group is substituted with a substituent. The position of the substituent and the number of the substituents are not particularly limited. It is noted that in a case where a
10 substituent has carbon atoms, the number of carbon atoms of the substituent is not included in the number of carbon atoms of a group having the substituent. For example, an ethyl group having a phenyl group as a substituent is regarded as an alkyl group having 2 carbon atoms.

15 The non-volatile components in the present embodiment are components of the resin composition for a lens, excluding volatile components such as a solvent.

[0016]

[Resin composition for lens]

20 The resin composition for a lens according to the first embodiment of the present invention includes a photocationic polymerization initiator (X) containing a salt formed of an anion represented by General Formula (1) and a cation, an epoxy compound (Y) containing equal to or more than two epoxy groups
25 in a molecule, and a stabilizer having a base dissociation constant pK_b of equal to or more than 6.0, which is measured according to the following <Method for measuring base

dissociation index pK_b .

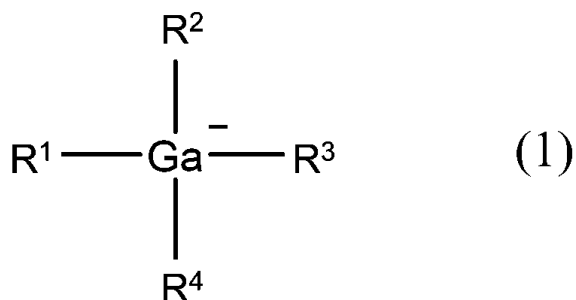
<Method for measuring base dissociation index pK_b >

0.1 g of a stabilizer is dissolved in 100 g of an 80% by mass methanol-containing aqueous solution, and the pH is

5 measured with a pH meter while the solution is titrated with a 3 N-HCl aqueous solution to obtain a pH titration curve. The pK_b value is calculated by a graphical method using the obtained pH titration curve.

[0017]

10 [chem. 11]



[0018]

In General Formula (1), R^1 to R^4 each independently represent an alkyl group having 1 to 18 carbon atoms or an aryl
15 group having 6 to 14 carbon atoms.

[0019]

The resin composition for a lens according to the first embodiment of the present invention can form a cured substance having an improved performance balance of a high refractive
20 index, a high light transmittance, high heat resistance, and high bleed-out resistance. In a case where the occurrence of bleed-out in ultraviolet curing and heating is suppressed, the

generation of foreign matter can be suppressed. Although the detailed mechanism is not revealed, it is presumed that since the photocationic polymerization initiator containing anionic gallium hardly generates a strong acid component even in a case of being heated, the deterioration of coloring, generation of foreign matter, or the like due to heating is suppressed. In addition, the photocationic polymerization initiator containing an anionic gallium can suppress adverse effects on various performances such as a high refractive index, a high light transmittance, and high heat resistance while exhibiting polymerization performance at the level of the related art. Furthermore, it is considered that the stabilizer having a base dissociation constant pK_b of equal to or more than 6.0 according to <Method for measuring base dissociation index pK_b > can be prevented from bonding to a strong acid component and can suppress bleed-out due to a change in compatibility by being used in combination with a photocationic polymerization initiator including an anionic gallium that hardly generates a strong acid component even by heating.

[0020]

From the viewpoint of further improving the performance balance of high refractive index, high light transmittance, high heat resistance, color fastness, and bleed-out resistance, the above-described base dissociation constant pK_b of the stabilizer in the resin composition for a lens according to the first embodiment of the present invention is equal to or more than 6.0, more preferably equal to or more than 7.0, still more

preferably equal to or more than 8.0, even more preferably equal to or more than 9.0, and yet more preferably equal to or more than 10.0, and is preferably equal to or less than 15.0, more preferably equal to or less than 14.0, still more preferably
5 equal to or less than 13.0, even more preferably equal to or less than 12.0, and most preferably equal to or less than 11.5.

That is, from the viewpoint of further improving the performance balance of high refractive index, high light transmittance, high heat resistance, color fastness, and
10 resistance to bleed-out, the above-described base dissociation constant pK_b of the stabilizer in the resin composition for a lens according to the first embodiment of the present invention is equal to or more than 6.0, preferably equal to or more than 6.0 and equal to or less than 15.0, more preferably equal to or
15 more than 7.0 and equal to or less than 14.0, still more preferably equal to or more than 8.0 and equal to or less than 13.0, even still more preferably equal to or more than 9.0 and equal to or less than 12.0, and even still more preferably equal to or more than 10.0 and equal to or less than 11.5.

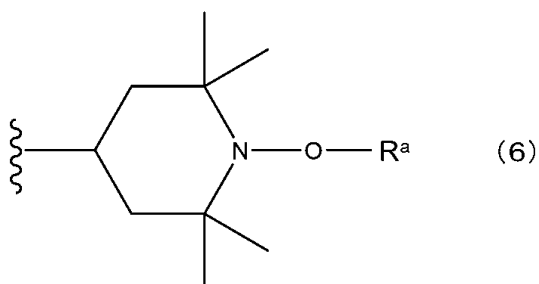
20 [0021]

The stabilizer in the resin composition for a lens according to the first embodiment of the present invention preferably includes a stabilizer including one or equal to or more than two kinds of partial structures selected from the
25 group consisting of a partial structure represented by General Formula (6) and a partial structure represented by General Formula (7), and more preferably includes a stabilizer including

a partial structure represented by General Formula (6).

[0022]

[chem. 12]

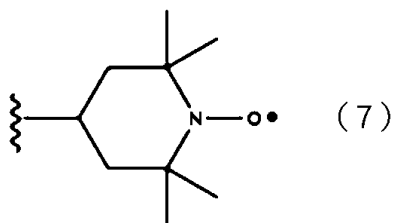


5 [0023]

In General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms.

[0024]

10 [chem. 13]



[0025]

In General Formula (7), $O\cdot$ represents an oxyl group.

[0026]

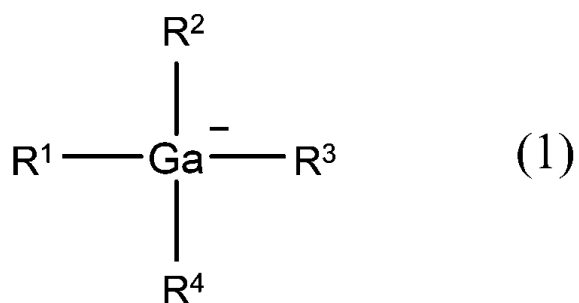
15 The resin composition for a lens according to the second embodiment of the present invention contains a photocationic polymerization initiator (X) containing a salt formed of an anion represented by General Formula (1) and a cation, an epoxy compound (Y) containing equal to or more than two epoxy groups
20 in a molecule, and a stabilizer containing one or equal to or

more than two kinds of partial structures selected from the group consisting of a partial structure represented by General Formula (6) and a partial structure represented by General Formula (7), and preferably contains a photocationic

- 5 polymerization initiator (X) containing a salt formed of an anion represented by General Formula (1) and a cation, an epoxy compound (Y) containing equal to or more than two epoxy groups in a molecule, and a stabilizer containing a partial structure represented by General Formula (6).

10 [0027]

[chem. 14]

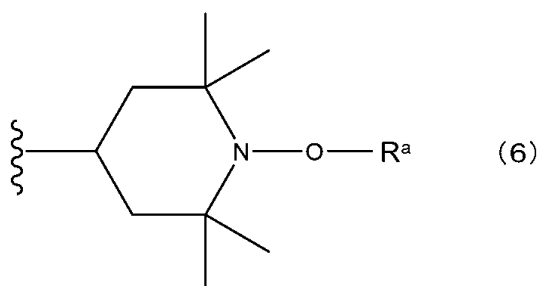


[0028]

- In General Formula (1), R¹ to R⁴ each independently
 15 represent an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms.

[0029]

[chem. 15]

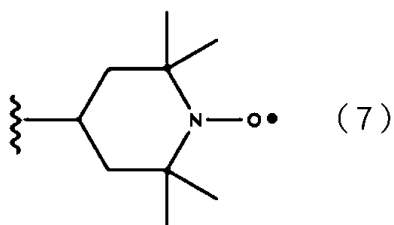


[0030]

In General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms.

[0031]

[chem. 16]



[0032]

In General Formula (7), $O\cdot$ represents an oxyl group.

[0033]

The resin composition for a lens according to the second embodiment of the present invention can form a cured substance having an improved performance balance of a high refractive index, a high light transmittance, high heat resistance, and high bleed-out resistance. In a case where the occurrence of bleed-out in ultraviolet curing and heating is suppressed, the generation of foreign matter can be suppressed. Although the detailed mechanism is not revealed, it is presumed that since the photocationic polymerization initiator containing anionic

gallium hardly generates a strong acid component even in a case of being heated, the deterioration of coloring, generation of foreign matter, or the like due to heating is suppressed. In addition, the photocationic polymerization initiator containing an anionic gallium can suppress adverse effects on various performances such as a high refractive index, a high light transmittance, and high heat resistance while exhibiting polymerization performance at the level of the related art. Furthermore, it is considered that, in a case of using the stabilizer including one or equal to or more than two kinds of partial structures selected from the group consisting of the partial structure represented by General Formula (6) and the partial structure represented by General Formula (7) in combination with a photocationic polymerization initiator including an anionic gallium that hardly generates a strong acid component even by heating, the binding to the strong acid component can be prevented, and the bleed-out due to the change in compatibility can be suppressed.

[0034]

Hereinafter, each component contained in the resin composition for a lens of the first embodiment of the present invention and the second embodiment of the present invention (hereinafter, collectively referred to as the present embodiment) will be described in detail.

[0035]

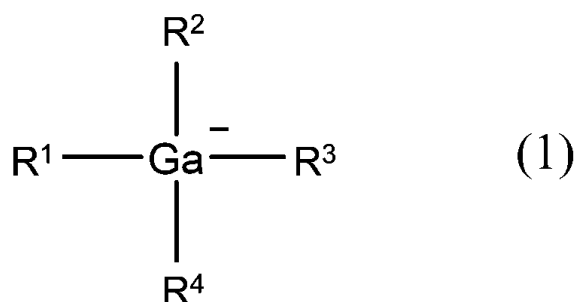
<Photocationic polymerization initiator (X)>

The resin composition for a lens according to the present

embodiment contains a photocationic polymerization initiator (X) including a salt formed from an anion represented by General Formula (1) and a cation.

[0036]

5 [chem. 17]



[0037]

In General Formula (1), R¹ to R⁴ each independently represent an alkyl group having 1 to 18 carbon atoms or an aryl
10 group having 6 to 14 carbon atoms.

[0038]

The alkyl group having 1 to 18 carbon atoms, which is represented by R¹ to R⁴ in General Formula (1), is not limited and may be any one of a linear, branched, or cyclic alkyl group.

15 Specific examples thereof include an alkyl group such as a methyl group, an ethyl group, a propyl group, an isopropyl group, an n-butyl group, a t-butyl group, a hexyl group, an octyl group, a 2-ethylhexyl group, or a decyl group; and a cycloalkyl group such as a cyclopentyl group, or cyclohexyl
20 group, a cyclooctyl group, a norbornyl group, a bicyclononyl group, or a tricyclodecane group.

[0039]

Specific examples of the aryl group having 6 to 14 carbon atoms, which is represented by R^1 to R^4 in General Formula (1), include a phenyl group, a tolyl group, a naphthyl group, a biphenyl group, a terphenyl group, a phenanthryl group, or an anthracenyl group.

[0040]

The alkyl group having 1 to 18 carbon atoms or the aryl group having 6 to 14 carbon atoms, which is represented by R^1 to R^4 in General Formula (1), may have a substituent.

10 [0041]

The substituent which may be contained in the alkyl group having 1 to 18 carbon atoms or the aryl group having 6 to 14 carbon atoms, which is represented by R^1 to R^4 in General Formula (1), is not particularly limited. Examples thereof include a halogen atom, a hydrocarbon group, a halogen-containing group, an oxygen-containing group, a sulfur-containing group, and a nitrogen-containing group.

[0042]

Examples of the halogen atom include a fluorine atom, a chlorine atom, or a bromine atom.

[0043]

Examples of the hydrocarbon group include an alkyl group such as a methyl group, an ethyl group, a propyl group, an isopropyl group, an n-butyl group, a t-butyl group, a hexyl group, an octyl group, a 2-ethylhexyl group, or a decyl group; and a cycloalkyl group such as a cyclopentyl group, or cyclohexyl group, a cyclooctyl group, a norbornyl group, a

bicyclononyl group, or a tricyclodecane group; an aryl group such as a phenyl group, a tolyl group, a naphthyl group, a biphenyl group, a terphenyl group, a phenanthryl group, or an anthracenyl group; an aralkyl group such as a benzyl group or a phenylethyl group; and a diene-based divalent derivative group such as a 1,3-butadienyl group, an isoprenyl (2-methyl-1,3-butadienyl) group, a piperylenyl (1,3-pentadienyl) group, a 2,4-hexadienyl group, a 1,4-diphenyl-1,3-pentadienyl group, or a cyclopentadienyl group.

10 [0044]

Examples of the halogen-containing group which may be contained in the alkyl group having 1 to 18 carbon atoms or the aryl group having 6 to 14 carbon atoms, which is represented by R^1 to R^4 include a halogen-containing hydrocarbon group such as trifluoromethyl, pentafluoroethyl, 1,1,1,3,3,3-hexafluoro-2-propyl, or nonafluoro-t-butyl; and a halogen-containing aryl group such as pentafluorophenyl or pentachlorophenyl.

[0045]

Examples of the oxygen-containing group include an alkoxy group such as a methoxy group, an ethoxy group, an n-propoxy group, an isopropoxy group, an n-butoxy group, an isobutoxy group, or a t-butoxy group; an aryloxy group such as a phenoxy group, a 2,6-dimethylphenoxy group, or a 2,4,6-trimethylphenoxy group; an ester group such as an acetyloxy group, a benzoyloxy group, a methoxycarbonyl group, a phenoxycarbonyl group, or a p-chlorophenoxycarbonyl group; an ether group; an acyl group such as a formyl group, an acetyl group, a benzoyl group, a p-

chlorobenzoyl group, or a p-methoxybenzoyl group; a carboxyl group; a carbonate group; a hydroxy group; a peroxy group; a carboxylic acid anhydride group; and a furyl group.

[0046]

5 Examples of the sulfur-containing group include a mercapto group; a thioester group such as an acetylthio group, a benzoylthio group, a methylthiocarbonyl group, or a phenylthiocarbonyl group; a dithioester group; an alkylthio group such as a methylthio group or an ethylthio group; an
10 arylthio group such as a phenylthio group, a methylphenylthio group, or a naphthylthio group; a thioacyl group; a thioether group; a thiocyanic acid ester group; an isothiocyanic acid ester group; a sulfonic acid ester group such as a methyl sulfonate group, an ethyl sulfonate group, or a phenyl sulfonate
15 group; a sulfonamide group such as a phenylsulfonamide group, a N-methylsulfonamide group, or an N-methyl-p-toluenesulfamide group; a thiocarboxyl group; a dithiocarboxyl group; a sulfo group; a sulfonyl group; a sulfinyl group; and a sulfenyl group.

[0047]

20 Examples of the nitrogen-containing group include an amino group; an alkylamino group such as a dimethylamino group or an ethylmethylamino group; an arylamino group such as a diphenylamino group; an imino group; an alkylimino group such as a methylimino group, an ethylimino group, a propylimino group,
25 or a butylimino group; an arylimino group such as a phenylimino group; an amide group; an alkylamide group such as an acetamide group or an N-methylacetamide group; an arylamide group such as

an N-methylbenzamide group; an amide group; an alkylimide group such as an acetimide group; an arylimide group such as a benzimide group; a pyrrolidino group; a hydrazino group; a hydrazono group; a nitro group; a nitroso group; a cyano group; 5 an isocyano group; a cyanic acid ester group; an amidino group; a diazo group; and an amino group.

[0048]

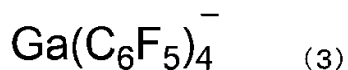
It is preferable that equal to or more than three of R¹ to R⁴ are an aryl group having 6 to 14 carbon atoms, it is more 10 preferable that all of R¹ to R⁴ are an aryl group having 6 to 14 carbon atoms, it is still more preferable that all of R¹ to R⁴ are an aryl group having 6 to 8 carbon atoms, and it is still more preferable that all of R¹ to R⁴ are an aryl group having 6 carbon atoms.

15 [0049]

R¹ to R⁴ preferably have a halogen atom as a substituent and more preferably have a fluorine atom as a substituent. Specifically, the photocationic polymerization initiator (X) preferably includes at least one selected from an anion 20 represented by Formula (3) or an anion represented by Formula (4) as an anion. This makes it possible to further improve the heat resistance of the cured body for a lens, which is formed from the resin composition for a lens.

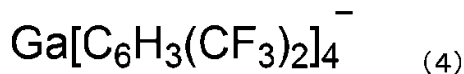
[0050]

25 [chem. 18]



[0051]

[chem. 19]



[0052]

5 The photocationic polymerization initiator (X) contains a cation that forms a salt with an anion represented by General Formula (1).

[0053]

10 The cation that forms a salt with the anion represented by General Formula (1) is not particularly limited as long as it is a monovalent cation. Examples thereof include an oxonium ion, an ammonium ion, a phosphonium ion, a sulfonium ion, and an iodonium ion.

[0054]

15 Examples of the oxonium ion include oxonium such as trimethyloxonium, diethylmethyloxonium, triethyloxonium, and tetramethylenemethyloxonium; pyrylium such as 4-methylpyrylium, 2,4,6-trimethylpyrylium, 2,6-di-tert-butylpyrylium, and 2,6-diphenylpyrylium; chromium such as 2,4-dimethylchromium and 1,3-
20 dimethylisochromium; and isochromium.

[0055]

25 Examples of the ammonium ion include pyrrolidinium such as N,N-dimethylpyrrolidinium, N-ethyl-N-methylpyrrolidinium, and N,N-diethylpyrrolidinium; imidazolinium such as N,N'-dimethylimidazolinium, N,N'-diethylimidazolinium, N-ethyl-N'-methylimidazolinium, 1,3,4-trimethylimidazolinium, and 1,2,3,4-

tetramethylimidazolinium; tetrahydropyrimidinium such as N,N'-dimethyltetrahydropyrimidinium; morpholinium such as N,N'-dimethylmorpholinium; piperidinium such as N,N'-diethylpiperidinium; pyridinium such as N-methylpyridinium, N-benzylpyridinium, and N-phenacylpyridinium; imidazolium such as N,N'-dimethylimidazolium; quinolium such as N-methylquinolium, N-benzylquinolium, and N-phenacylquinolium; isoquinolium such as N-methylisoquinolium; thiazonium such as benzylbenzothiazonium and phenacylbenzothiazonium; and acrydium such as benzylacrydium and phenacylacrydium.

[0056]

Examples of the phosphonium ion include tetraarylphosphoniums such as tetraphenylphosphonium, tetra-p-tolylphosphonium, tetrakis(2-methoxyphenyl)phosphonium, tetrakis(3-methoxyphenyl)phosphonium, and tetrakis(4-methoxyphenyl)phosphonium; triphenyl triarylphosphoniums such as benzylphosphonium, triphenylphenacylphosphonium, triphenylmethylphosphonium, and triphenylbutylphosphonium; and tetraalkylphosphoniums such as triethylbenzylphosphonium, tributylbenzylphosphonium, tetraethylphosphonium, tetrabutylphosphonium, tetrahexylphosphonium, triethylphenacylphosphonium, and tributylphenacylphosphonium.

[0057]

Examples of the sulfonium ion include triphenylsulfonium, tri-p-tolylsulfonium, tri-o-tolylsulfonium, tris(4-methoxyphenyl)sulfonium, 1-naphthyl diphenylsulfonium, 2-naphthyl diphenylsulfonium, tris(4-fluorophenyl)sulfonium, tri-1-

naphthylsulfonium, tri-2-naphthylsulfonium, tris(4-hydroxyphenyl)sulfonium, 4-(phenylthio)phenyldiphenylsulfonium, 4-(p-tolylthio)phenyldiphenylsulfonium, 4-(4-methoxyphenylthio)phenylbis(4-methoxyphenyl)sulfonium, 4-

5 (phenylthio)phenylbis(4-fluorophenyl)sulfonium, 4-(phenylthio)phenylbis(4-methoxyphenyl)sulfonium, 4-(phenylthio)phenyldi-p-tolylsulfonium, [4-(4-biphenylthio)phenyl]-4-biphenylphenylsulfonium, [4-(2-thioxantonylthio)phenyl]diphenylsulfonium, bis[4-

10 (diphenylsulfonylo)phenyl]sulfide, bis[4-{bis[4-(2-hydroxyethoxy)phenyl]sulfonio}phenyl]sulfide, bis{4-[bis(4-fluorophenyl)sulfonio]phenyl}sulfide, bis{4-[bis(4-methylphenyl)sulfonio]phenyl}sulfide, triarylsulfonium such as bis{4-[bis(4-methoxyphenyl)sulfonio]phenyl}sulfide, 4-(4-

15 benzoyl-2-chlorophenylthio)phenylbis(4-fluorophenyl)sulfonium, 4-(4-benzoyl-2-chlorophenylthio)phenyldiphenylsulfonium, 4-(4-benzoylphenylthio)phenylbis(4-fluorophenyl)sulfonium, 4-(4-benzoylphenylthio)phenyldiphenylsulfonium, 7-isopropyl-9-oxo-10-thia-9,10-dihydroanthracene-2-yl di-p-tolylsulfonium, 7-

20 isopropyl-9-oxo-10-thia-9,10-dihydroanthracene-2-yl diphenylsulfonium, 2-[(di-p-tolyl)sulfonio]thioxanthone, 2-[(diphenyl)sulfonio]thioxanthone, 4-(9-oxo-9H-thioxanthen-2-yl)thiophenyl-9-oxo-9H-thioxanthen-2-ylphenylsulfonium, 4-[4-(4-tert-butylbenzoyl)phenylthio]phenyl di-p-tolylsulfonium, 4-[4-

25 (4-tert-butylbenzoyl)phenylthio]phenyldiphenylsulfonium, 4-[4-(benzoylphenylthio)]phenyl di-p-tolylsulfonium, 4-[4-(benzoylphenylthio)]phenyldiphenylsulfonium, 5-(4-

methoxyphenyl)thioantimony trioxide, 5-phenylthioantimony trioxide, 5-tolylthioantimony trioxide, 5-(4-ethoxyphenyl)thioantimony trioxide, and 5-(2,4,6-trimethylphenyl)thioantimony trioxide;

- 5 diphenylphenacylsulfonium, diarylsulfonium such as diphenyl 4-nitrophenacylsulfonium, diphenylbenzylsulfonium, and diphenylmethylsulfonium; monoarylsulfonium such as phenylmethylbenzylsulfonium, 4-hydroxyphenylmethylbenzylsulfonium, 4-methoxyphenylmethylbenzylsulfonium, 4-acetoxycarbonyloxyphenylmethylbenzylsulfonium, 4-hydroxyphenyl(2-naphthylmethyl)methylsulfonium, 2-naphthylmethylbenzylsulfonium, 2-naphthylmethyl(1-ethoxycarbonyl)ethylsulfonium, phenylmethylphenacylsulfonium, 4-hydroxyphenylmethylphenacylsulfonium, 4-methoxyphenylmethylphenacylsulfonium, 4-acetoxycarbonyloxyphenylmethylphenacylsulfonium, 2-naphthylmethylphenacylsulfonium, 2-naphthylmethylphenacylsulfonium, and 9-anthracenylmethylphenacylsulfonium; trialkylsulfonium such as dimethylphenacylsulfonium, phenacyl tetrahydrothiophenium, dimethylbenzylsulfonium, benzyl tetrahydrothiophenium, and octadecylmethylphenacylsulfonium; and the like.

[0058]

- 25 Examples of the iodonium ion include diphenyliodonium, di-p-tolylodonium, bis(4-dodecylphenyl)iodonium, bis(4-methoxyphenyl)iodonium, (4-octyloxyphenyl)phenyliodonium, bis(4-

decyloxy)phenyliodonium, 4-(2-hydroxytetradecyloxy)phenylphenyliodonium, 4-isopropylphenyl (p-tolyl)iodonium, and 4-isobutylphenyl (p-tolyl)iodonium.

[0059]

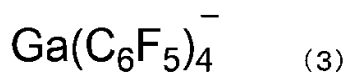
5 The photocationic polymerization initiator (X) preferably includes, as a cation, at least one selected from an ammonium ion, a phosphonium ion, a sulfonium ion, or an iodonium ion, more preferably includes at least one selected from a sulfonium ion or an iodonium ion, still more preferably includes a
10 sulfonium ion, and even still more preferably includes a triarylsulfonium.

[0060]

 The photocationic polymerization initiator (X) preferably contains a salt composed of at least one selected from an anion
15 represented by Formula (3) or an anion represented by Formula (4), and a sulfonium ion. This makes it possible to further improve the heat resistance of the cured body for a lens, which is formed from the resin composition for a lens.

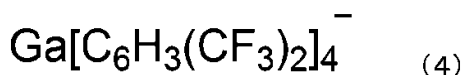
[0061]

20 [chem. 20]



[0062]

[chem. 21]

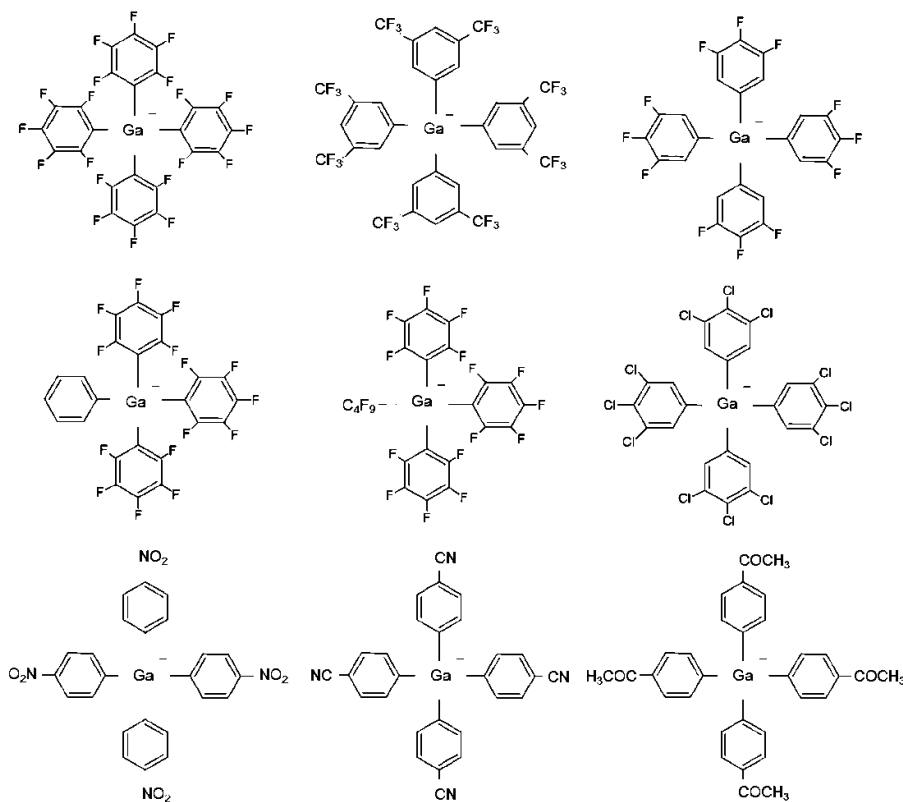


25 [0063]

Specific examples of the anion contained in the photocationic polymerization initiator (X) are shown below. However, the anion contained in the photocationic polymerization initiator (X) in the present embodiment is not limited thereto.

5 [0064]

[chem. 22]



[0065]

It is possible to synthesize the photocationic polymerization initiator (X) according to, for example, the known method described in Pamphlet of International Publication No. W02018/020974. In addition, commercially available CPI-310FG (product name: Photocationic Polymerization Initiator, manufactured by San-Apro Ltd.) or the like may be obtained and used.

10

15

[0066]

The lower limit value of the content of the photocationic polymerization initiator (X) in the resin composition for a lens according to the present embodiment is preferably equal to or
5 more than 0.05 parts by mass, more preferably equal to or more than 0.07 parts by mass, still more preferably equal to or more than 0.1 parts by mass, even still more preferably equal to or more than 0.5 parts by mass, even still more preferably equal to or more than 1.0 part by mass, and even still more preferably
10 equal to or more than 1.5 parts by mass with respect to 100 parts by mass of the epoxy compound (Y). In this manner, the performance balance of high refractive index and high heat resistance can be improved.

In addition, the upper limit value of the content of the
15 photocationic polymerization initiator (X) in the resin composition for a lens of the present embodiment is preferably equal to or less than 15 parts by mass, more preferably equal to or less than 10 parts by mass, still more preferably equal to or less than 8 parts by mass, and even still more preferably equal
20 to or less than 6 parts by mass with respect to 100 parts by mass of the epoxy compound (Y). In this manner, a performance balance between high light transmittance and bleed resistance can be improved.

One kind of the photocationic polymerization initiator (X)
25 may be used alone, or a plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective

photocationic polymerization initiators (X) is defined as the content of the photocationic polymerization initiator (X).

[0067]

It is noted that in a case where the photocationic
5 polymerization initiator (X) has a high molar absorption coefficient at a wavelength of 300 to 380 nm, the molar absorption coefficient may be adjusted to an appropriate content according to the volume or thickness in a case of using the resin composition for a lens.

10 [0068]

<Epoxy compound (Y)>

The resin composition for a lens according to the present embodiment contains an epoxy compound (Y) containing equal to or more than two epoxy groups in a molecule.

15 [0069]

Examples of the epoxy compound (Y) having equal to or more than two epoxy groups in the molecule include diethylene glycol diglycidyl ether, hexanediol diglycidyl ether, dimethylolpropane diglycidyl ether, polypropylene glycol diglycidyl ether,
20 trimethylolpropane triglycidyl ether, and pentaerythritol tetraglycidyl ether.

[0070]

In addition, Examples of the epoxy compound (Y) having equal to or more than two epoxy groups in the molecule also
25 include alicyclic epoxy resins such as 3',4'-epoxycyclohexylmethyl-3,4-epoxycyclohexanecarboxylate and ϵ -caprolactone-modified 3',4'-epoxycyclohexylmethyl-3,4-

epoxycyclohexanecarboxylate.

[0071]

Further, Examples of the epoxy compound (Y) having equal to or more than two epoxy groups in the molecule also include epoxy resins having an aromatic ring, such as a bisphenol A type epoxy compound, a bisphenol F type epoxy compound, a biphenyl-phenol novolak type epoxy compound, and an epoxy compound obtained by epoxidizing a part or all of alcoholic hydroxyl groups contained in the structure of these epoxy compounds.

10 [0072]

Examples of commercially available products of the epoxy compound (Y) include EPICLON series (bisphenol A type epoxy resin, manufactured by DIC Corporation) represented by EXA-850CRP, jER series (manufactured by Mitsubishi Chemical Corporation) represented by jER828, YD series (manufactured by NIPPON STEEL Chemical & Material Co., Ltd.) represented by YD-127, and TECHMORE VG3101L (trifunctional epoxy resin, manufactured by Printec Corporation).

[0073]

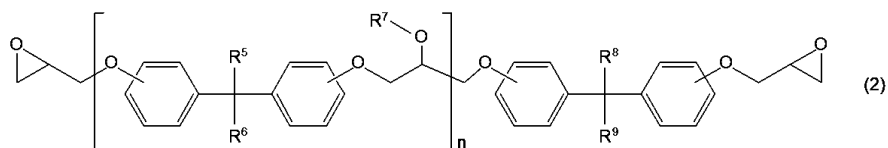
20 The epoxy compound (Y) is preferably an epoxy compound having an aromatic ring. This makes it possible to increase the refractive index of the cured substance obtained by curing the resin composition for a lens and makes it possible to improve the optical characteristics of the lens.

25 [0074]

The epoxy compound (Y) is preferably an epoxy compound represented by General Formula (2).

[0075]

[chem. 23]



[0076]

5 In General Formula (2), R^5 , R^6 , R^8 , and R^9 each independently represent a hydrogen atom, an alkyl group having 1 to 4 carbon atoms, or a trifluoromethyl group, R^7 represents a hydrogen atom or a glycidyl group, and n is an average repetition number, where n represents a real number in a range of 0 to 30.

10 [0077]

Examples of the alkyl group having 1 to 4 carbon atoms represented by R^5 , R^6 , R^8 , and R^9 include those having 1 to 4 carbon atoms among those exemplified as the alkyl group having 1 to 18 carbon atoms represented by R^1 to R^4 .

15 [0078]

R^5 , R^6 , R^8 , and R^9 are preferably an alkyl group having 1 to 4 carbon atoms or a trifluoromethyl group, more preferably a methyl group or a trifluoromethyl group, and still more preferably a methyl group.

20 [0079]

n is preferably 1 to 20, and more preferably 5 to 15. It is noted that n is calculated from the value of the weight average molecular weight calculated in terms of polystyrene, based on the measurement result of gel permeation chromatography (GPC).

25 [0080]

The epoxy equivalent of the epoxy compound (Y) is not particularly limited; however, it is preferably equal to or more than 100 g/eq and equal to or less than 200 g/eq, and more preferably equal to or more than 120 g/eq and equal to or less than 180 g/eq. It is noted that the epoxy equivalent in the present specification is a value measured by a method in accordance with JIS K7236.

[0081]

In a case where the total amount of the non-volatile components of the resin composition for a lens according to the present embodiment is set to 100% by mass, the lower limit value of the content of the epoxy compound (Y) is preferably equal to or more than 40% by mass, more preferably equal to or more than 45% by mass, and still more preferably equal to or more than 50% by mass. In this manner, a performance balance between high light transmittance and bleed resistance can be improved.

In a case where the total amount of the non-volatile components in the resin composition for a lens according to the present embodiment is set to 100% by mass, the upper limit value of the content of the epoxy compound (Y) is preferably equal to or less than 99% by mass, more preferably equal to or less than 90% by mass, still more preferably equal to or less than 80% by mass, even more preferably equal to or less than 70% by mass, and even still more preferably equal to or less than 60% by mass. In this manner, the performance balance of high refractive index and high heat resistance can be improved.

One kind of the epoxy compound (Y) may be used alone, or a

plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective epoxy compounds (Y) is defined as the content of the epoxy compound (Y).

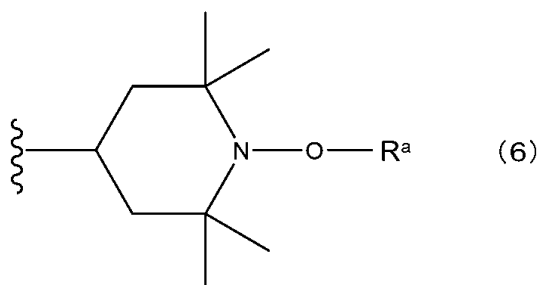
5 [0082]

<Stabilizer>

The resin composition for a lens according to the present embodiment contains a stabilizer including one or equal to or more than two kinds of partial structures selected from the
 10 group consisting of a partial structure represented by General Formula (6) and a partial structure represented by General Formula (7).

[0083]

[chem. 24]



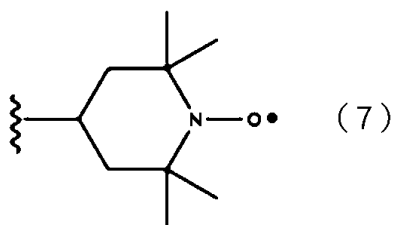
15

[0084]

In General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms.

20 [0085]

[chem. 25]



[0086]

In General Formula (7), O· represents an oxyl group.

[0087]

5 The alkyl group having 1 to 18 carbon atoms, which is represented by R^a in General Formula (6), is not limited and may be any one of a linear, branched, or cyclic alkyl group.

Specific examples thereof include an alkyl group such as a methyl group, an ethyl group, a propyl group, an isopropyl group, an n-butyl group, a t-butyl group, a hexyl group, an octyl group, a 2-ethylhexyl group, or a decyl group; and a cycloalkyl group such as a cyclopentyl group, or cyclohexyl group, a cyclooctyl group, a norbornyl group, a bicyclononyl group, or a tricyclodecane group.

15 [0088]

Specific examples of the aryl group having 6 to 14 carbon atoms, which is represented by R^a in General Formula (6), include a phenyl group, a tolyl group, a naphthyl group, a biphenyl group, a terphenyl group, a phenanthryl group, or an anthracenyl group.

[0089]

The alkyl group having 1 to 18 carbon atoms or the aryl group having 6 to 14 carbon atoms, which is represented by R^a in General Formula (6), may have a substituent.

[0090]

The substituent which may be contained in the alkyl group having 1 to 18 carbon atoms or the aryl group having 6 to 14 carbon atoms, which is represented by R^a in General Formula (6),
5 is not particularly limited. Examples thereof include a halogen atom, a hydrocarbon group, a halogen-containing group, an oxygen-containing group, a sulfur-containing group, and a nitrogen-containing group.

[0091]

10 Examples of the halogen atom include a fluorine atom, a chlorine atom, or a bromine atom.

[0092]

Examples of the hydrocarbon group include an alkyl group such as a methyl group, an ethyl group, a propyl group, an
15 isopropyl group, an n-butyl group, a t-butyl group, a hexyl group, an octyl group, a 2-ethylhexyl group, or a decyl group; and a cycloalkyl group such as a cyclopentyl group, or cyclohexyl group, a cyclooctyl group, a norbornyl group, a bicyclononyl group, or a tricyclodecane group; an aryl group
20 such as a phenyl group, a tolyl group, a naphthyl group, a biphenyl group, a terphenyl group, a phenanthryl group, or an anthracenyl group; an aralkyl group such as a benzyl group or a phenylethyl group; and a diene-based divalent derivative group such as a 1,3-butadienyl group, an isoprenyl (2-methyl-1,3-
25 butadienyl) group, a piperidenyl (1,3-pentadienyl) group, a 2,4-hexadienyl group, a 1,4-diphenyl-1,3-pentadienyl group, or a cyclopentadienyl group.

[0093]

Examples of the halogen-containing group which may be contained in the alkyl group having 1 to 18 carbon atoms or the aryl group having 6 to 14 carbon atoms, which is represented by

5 R^a include a halogen-containing hydrocarbon group such as trifluoromethyl, pentafluoroethyl, 1,1,1,3,3,3-hexafluoro-2-propyl, or nonafluoro-t-butyl; and a halogen-containing aryl group such as pentafluorophenyl or pentachlorophenyl.

[0094]

10 Examples of the oxygen-containing group include an alkoxy group such as a methoxy group, an ethoxy group, an n-propoxy group, an isopropoxy group, an n-butoxy group, an isobutoxy group, or a t-butoxy group; an aryloxy group such as a phenoxy group, a 2,6-dimethylphenoxy group, or a 2,4,6-trimethylphenoxy

15 group; an ester group such as an acetyloxy group, a benzoyloxy group, a methoxycarbonyl group, a phenoxycarbonyl group, or a p-chlorophenoxycarbonyl group; an ether group; an acyl group such as a formyl group, an acetyl group, a benzoyl group, a p-chlorobenzoyl group, or a p-methoxybenzoyl group; a carboxyl

20 group; a carbonate group; a hydroxy group; a peroxy group; a carboxylic acid anhydride group; and a furyl group.

[0095]

Examples of the sulfur-containing group include a mercapto group; a thioester group such as an acetylthio group, a

25 benzoylthio group, a methylthiocarbonyl group, or a phenylthiocarbonyl group; a dithioester group; an alkylthio group such as a methylthio group or an ethylthio group; an

arylthio group such as a phenylthio group, a methylphenylthio group, or a naphthylthio group; a thioacyl group; a thioether group; a thiocyanic acid ester group; an isothiocyanic acid ester group; a sulfonic acid ester group such as a methyl

5 sulfonate group, an ethyl sulfonate group, or a phenyl sulfonate group; a sulfonamide group such as a phenylsulfonamide group, a N-methylsulfonamide group, or an N-methyl-p-toluenesulfamide group; a thiocarboxyl group; a dithiocarboxyl group; a sulfo group; a sulfonyl group; a sulfinyl group; and a sulfenyl group.

10 [0096]

Examples of the nitrogen-containing group include an amino group; an alkylamino group such as a dimethylamino group or an ethylmethylamino group; an arylamino group such as a diphenylamino group; an imino group; an alkylimino group such as

15 a methylimino group, an ethylimino group, a propylimino group, or a butylimino group; an arylimino group such as a phenylimino group; an amide group; an alkylamide group such as an acetamide group or an N-methylacetamide group; an arylamide group such as an N-methylbenzamide group; an amide group; an alkylimide group

20 such as an acetimide group; an arylimide group such as a benzimide group; a pyrrolidino group; a hydrazino group; a hydrazono group; a nitro group; a nitroso group; a cyano group; an isocyano group; a cyanic acid ester group; an amidino group; a diazo group; and an amino group.

25 [0097]

The stabilizer including the partial structure represented by General Formula (6) preferably includes a compound in which

R^a preferably has 1 to 15 carbon atoms, more preferably has 6 to 12 carbon atoms, still more preferably has 8 to 12 carbon atoms, and even still more preferably has 11 carbon atoms. In this manner, the performance balance of high refractive index, high light transmittance, high heat resistance, and high bleed-out resistance of the cured substance for a lens, which is formed of the resin composition according to the present embodiment, can be further improved.

[0098]

Examples of the stabilizer including one or equal to or more than two kinds of partial structures selected from the group consisting of the partial structure represented by General Formula (6) and the partial structure represented by General Formula (7) include hindered amine-based antioxidants such as bis[2,2,6,6-tetramethyl-1-(undecyloxy)piperidin-4-yl]=carbonate, bis[1-(octyloxy)-2,2,6,6-tetramethyl-4-piperidiny]sebacate, 2-[[4,6-bis[butyl[1-(cyclohexyloxy)-2,2,6,6-tetramethylpiperidin-4-yl]amino]-1,3,5-triazine-2-yl]amino]ethanol, and bis(2,2,6,6-tetramethyl-4-piperidyl-1-oxyl)sebacate. Examples of a commercially available product of such a stabilizer include LA-81 of ADEKA STAB series manufactured by ADEKA Corporation, and Tinuvin 123 and Tinuvin 152 manufactured by BASF SE.

[0099]

The lower limit value of the content of the stabilizer of the present embodiment, that is, the lower limit value of the content of the stabilizer including one or equal to or more than two kinds of partial structures selected from the group

consisting of the partial structure represented by General Formula (6) and the partial structure represented by General Formula (7) is preferably equal to or more than 0.01 parts by mass, more preferably equal to or more than 0.05 parts by mass, 5 still more preferably equal to or more than 0.10 parts by mass, and even still more preferably equal to or more than 0.15 parts by mass with respect to 100 parts by mass of the epoxy compound (Y). In this manner, the performance balance of high light transmittance and bleed-out resistance of the cured substance 10 for a lens, which is formed of the resin composition according to the present embodiment, can be further improved.

In addition, the upper limit value of the content of the stabilizer of the present embodiment, that is, the upper limit value of the content of the stabilizer including one or equal to 15 or more than two kinds of partial structures selected from the group consisting of the partial structure represented by General Formula (6) and the partial structure represented by General Formula (7) is preferably equal to or less than 5.0 parts by mass, more preferably equal to or less than 3.0 parts by mass, 20 still more preferably equal to or less than 1.0 part by mass, even still more preferably equal to or less than 0.5 parts by mass, even still more preferably equal to or less than 0.3 parts by mass, and even still more preferably equal to or less than 0.2 parts by mass with respect to 100 parts by mass of the epoxy 25 compound (Y). In this manner, the performance balance of high refractive index and high heat resistance of the cured substance for a lens, which is formed of the resin composition according

to the present embodiment, can be further improved.

That is, from the viewpoint of further improving the performance balance of high refractive index, high heat resistance, high light transmittance, and resistance to bleed-
5 out of the cured substance for a lens obtained by using the resin composition of the present embodiment, the content of the stabilizer of the present embodiment is preferably equal to or more than 0.01 parts by mass and equal to or less than 5.0 parts by mass, more preferably equal to or more than 0.01 parts by
10 mass and equal to or less than 3.0 parts by mass, still more preferably equal to or more than 0.01 parts by mass and equal to or less than 1.0 parts by mass, even still more preferably equal to or more than 0.05 parts by mass and equal to or less than 0.5 parts by mass, even further still more preferably equal to or
15 more than 0.10 parts by mass and equal to or less than 0.3 parts by mass, and even further still more preferably equal to or more than 0.15 parts by mass and equal to or less than 0.2 parts by mass with respect to 100 parts by mass of the epoxy compound (Y).

20 [0100]

The resin composition for a lens according to the present embodiment may further contain an antioxidant different from the above-described stabilizer, in addition to the above-described stabilizer.

25 [0101]

Examples of the antioxidant different from the above-described stabilizer include a phenol-based antioxidant, a

phosphorus-based antioxidant, a thioether-based antioxidant, and a hindered amine-based antioxidant.

[0102]

The antioxidant different from the stabilizer preferably
5 includes a phenol-based antioxidant, and more preferably includes a hindered phenol-based antioxidant.

[0103]

Examples of the hindered phenol-based antioxidant include 2,6-di-*t*-butylhydroxytoluene and pentaerythritol tetrakis[3-
10 (3,5-di-*tert*-butyl-4-hydroxyphenyl)propionate].

Examples of commercially available products of the hindered phenol-based antioxidant include ADEKA STAB series AO-20, AO-30, AO-40, AO-50, AO-60, and AO-80, manufactured by ADEKA Corporation.

15 [0104]

Examples of the phosphorus-based antioxidant include phosphines such as a trialkylphosphine and a triarylphosphine, a trialkyl phosphite, and a triaryl phosphite.

Examples of commercially available products of the
20 phosphorus-based antioxidant include ADEKA STAB series PEP-4C, PEP-8, PEP-24G, PEP-36, and HP-10, 260, 522A, 329K, 1178, 1500, 135A, and 3010 manufactured by ADEKA Corporation.

[0105]

Examples of commercially available products of thioether-
25 based antioxidants include ADEKA STAB series AO-26, AO-412S, and AO-503A, manufactured by ADEKA Corporation.

[0106]

Examples of the hindered amine-based antioxidant include 2,4-bis[N-butyl-N-(1-cyclohexyloxy-2,2,6,6-tetramethylpiperidin-4-yl)amino]-6-(2-hydroxyethylamine)-1,3,5-triazine and decanedioic acid bis(2,2,6,6-tetramethyl-1-(octyloxy)-4-piperidinyl) ester.

Examples of the commercially available product of the hindered amine-based antioxidant include hindered amine-based antioxidants such as 111FDL, 123, 144, 152, 292, and 5100 of the TINUVIN series manufactured by BASF.

[0107]

In a case where the resin composition for a lens according to the present embodiment further contains an antioxidant different from the above-described stabilizer, the content thereof may be appropriately set according to the purpose. From the viewpoint of obtaining a cured substance with little coloration, the lower limit value of the content of the antioxidant different from the stabilizer in the resin composition for a lens of the present embodiment is preferably equal to or more than 0.01 parts by mass, more preferably equal to or more than 0.1 parts by mass, still more preferably equal to or more than 0.3 parts by mass, even still more preferably equal to or more than 0.5 parts by mass, and even still more preferably equal to or more than 0.8 parts by mass with respect to 100 parts by mass of the epoxy compound (Y). In addition, from the viewpoint of obtaining a resin composition having excellent curing properties, the upper limit value of the content of the antioxidant different from the stabilizer is

preferably equal to or less than 5.0 parts by mass, more preferably equal to or less than 3.0 parts by mass, and still more preferably equal to or less than 1.0 part by mass.

[0108]

5 <Other components>

The resin composition for a lens according to the present embodiment may contain, as necessary, a monofunctional epoxy compound (Z), an oxetane compound (W), a solvent, an adhesiveness imparting agent, a polyol compound, a polyvalent
10 phenol compound, a sensitizing agent, an ion capture, a photocationic polymerization initiator (another photocationic polymerization initiator) other than the photocationic polymerization initiator (X), and the like.

[0109]

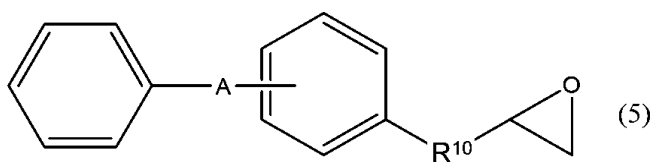
15 (Monofunctional epoxy compound (Z))

It is preferable that the resin composition for a lens according to the present embodiment preferably further contains a monofunctional epoxy compound (Z) represented by General Formula (5).

20 This makes it possible to further improve the heat resistance of the cured body for a lens, which is formed from the resin composition for a lens. In addition, it is possible to improve the glass adhesiveness of the resin composition for a lens.

25 [0110]

[chem. 26]



[0111]

In General Formula (5), A is selected from a single bond, an oxygen atom, and a sulfur atom, R¹⁰ is an alkylene having 1 to 8 carbon atoms, and any methylene group may be substituted with an oxygen atom.

[0112]

A is preferably a single bond.

R¹⁰ is preferably an alkylene having 1 to 4 carbon atoms, and more preferably an alkylene having 1 or 2 carbon atoms.

[0113]

It is preferable that any methylene group as R¹⁰ is substituted with an oxygen atom.

[0114]

The monofunctional epoxy compound (Z) preferably includes an o-phenylphenol glycidyl ether.

[0115]

Examples of commercially available products of the monofunctional epoxy compound (Z) include OPP-EP (o-phenylphenol glycidyl ether, manufactured by Yokkaichi Chemical Company Limited) and OPP-G (o-phenylphenol glycidyl ether, manufactured by SANKO Inc.).

[0116]

In a case where the resin composition for a lens according to the present embodiment contains the monofunctional epoxy

compound (Z), the lower limit value of the content of the monofunctional epoxy compound (Z) in the resin composition for a lens according to the present embodiment is preferably equal to or more than 1% by mass, more preferably equal to or more than 5% by mass, still more preferably equal to or more than 10% by mass, even still more preferably equal to or more than 20% by mass, even still more preferably equal to or more than 30% by mass, and even still more preferably equal to or more than 35% by mass, with respect to the non-volatile component of the resin composition for a lens according to the present embodiment. This makes it possible to further improve the heat resistance of the cured body for a lens, which is formed from the resin composition for a lens.

In addition, in a case where the resin composition for a lens according to the present embodiment contains the monofunctional epoxy compound (Z), the upper limit value of the content thereof in the non-volatile component of the resin composition for a lens according to the present embodiment is preferably equal to or less than 70% by mass, more preferably equal to or less than 60% by mass, still more preferably equal to or less than 50% by mass, and even still more preferably equal to or less than 40% by mass. In this manner, the glass adhesiveness of the resin composition for a lens can be further improved.

[0117]

In a case where the resin composition for a lens according to the present embodiment contains the monofunctional epoxy

compound (Z), the lower limit of the content of the monofunctional epoxy compound (Z) in the resin composition for a lens according to the present embodiment is preferably equal to or more than 1 part by mass, more preferably equal to or more than 5 parts by mass, still more preferably equal to or more than 10 parts by mass, even still more preferably equal to or more than 20 parts by mass, even still more preferably equal to or more than 30 parts by mass, even still more preferably equal to or more than 40 parts by mass, even still more preferably equal to or more than 50 parts by mass, even still more preferably equal to or more than 60 parts by mass, and even still more preferably equal to or more than 65 parts by mass with respect to 100 parts by mass of the epoxy compound (Y). This makes it possible to further improve the heat resistance of the cured body for a lens, which is formed from the resin composition for a lens.

In addition, in a case where the resin composition for a lens according to the present embodiment contains the monofunctional epoxy compound (Z), the upper limit value of the content thereof is preferably equal to or less than 200 parts by mass, more preferably equal to or less than 150 parts by mass, still more preferably equal to or less than 100 parts by mass, even still more preferably equal to or less than 80 parts by mass, and even still more preferably equal to or less than 75 parts by mass with respect to 100 parts by mass of the epoxy compound (Y). In this manner, the glass adhesiveness of the resin composition for a lens can be further improved.

[0118]

The monofunctional epoxy compound (Z) may be used alone or in combination of a plurality of kinds thereof, and in a case where a plurality of kinds thereof are used in combination, the
5 total content of the monofunctional epoxy compounds (Z) is defined as the content of the monofunctional epoxy compound (Z).

[0119]

(Oxetane compound (W))

It is preferable that the resin composition for a lens
10 according to the present embodiment further contains an oxetane compound (W).

This makes it possible to further improve the heat resistance of the cured body for a lens, which is formed from the resin composition for a lens. In addition, it is possible
15 to improve the glass adhesiveness of the resin composition for a lens. In addition, this makes it possible to improve the curability of the resin composition.

[0120]

The oxetane compound (W) is not particularly limited, and a
20 generally known compound can be used. Specific examples of the oxetane compound (W) include oxetane, 2-methyloxetane, 3-methyloxetane, 2,2-dimethyloxetane, 3,3-dimethyloxetane, 3-ethyl-3-hydroxymethyloxetane, and a biphenyl type oxetane.

[0121]

25 One kind of the oxetane compound (W) may be used alone, or a plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total

of contents of the respective oxetane compounds (W) is defined as the content of the oxetane compound (W).

[0122]

The oxetane compound (W) preferably includes a biphenyl-
5 type oxetane compound. Specific examples of the biphenyl type oxetane include xylylene bisoxetane.

[0123]

Examples of commercially available products of the oxetane compound (W) include ARONE OXETANE OXT-101 (3-ethyl-3-
10 hydroxymethyloxetane, manufactured by Toagosei Company, Limited) and ARON OXETANE OXT-121 (xylylene bisoxetane, manufactured by Toagosei Company, Limited).

[0124]

In a case where the resin composition for a lens according
15 to the present embodiment contains the oxetane compound (W), the lower limit of the content of the oxetane compound (W) in the resin composition for a lens according to the present embodiment is preferably equal to or more than 0.01% by mass, more preferably equal to or more than 0.1% by mass, still more
20 preferably equal to or more than 1% by mass, even still more preferably equal to or more than 2% by mass, even still more preferably equal to or more than 3% by mass, and even still more preferably equal to or more than 4% by mass, with respect to the non-volatile component of the resin composition for a lens
25 according to the present embodiment. In this manner, the heat resistance of the cured substance for a lens formed of the resin composition for a lens and the curability of the resin

composition for a lens can be further improved.

In addition, in a case where the resin composition for a lens according to the present embodiment contains the oxetane compound (W), the upper limit value of the content of the oxetane compound (W) in the resin composition for a lens according to the present embodiment is preferably equal to or less than 50% by mass, more preferably equal to or less than 40% by mass, still more preferably equal to or less than 30% by mass, even still more preferably equal to or less than 20% by mass, even still more preferably equal to or less than 10% by mass, and even still more preferably equal to or less than 5% by mass. In this manner, the glass adhesiveness of the resin composition for a lens can be further improved.

[0125]

In a case where the resin composition for a lens according to the present embodiment contains the oxetane compound (W), the lower limit of the content of the oxetane compound (W) in the resin composition for a lens according to the present embodiment is preferably equal to or more than 1 part by mass, more preferably equal to or more than 5 parts by mass, and still more preferably equal to or more than 9 parts by mass with respect to 100 parts by mass of the epoxy compound (Y). In this manner, the heat resistance of the cured substance for a lens formed of the resin composition for a lens and the curability of the resin composition for a lens can be further improved.

In addition, in a case where the resin composition for a lens according to the present embodiment contains the oxetane

compound (W), the upper limit value of the content of the oxetane compound (W) in the resin composition for a lens according to the present embodiment is preferably equal to or less than 200 parts by mass, more preferably equal to or less than 150 parts by mass, still more preferably equal to or less than 100 parts by mass, even still more preferably equal to or less than 80 parts by mass, even still more preferably equal to or less than 60 parts by mass, even still more preferably equal to or less than 40 parts by mass, even still more preferably equal to or less than 25 parts by mass, even still more preferably equal to or less than 15 parts by mass, and even still more preferably equal to or less than 10 parts by mass. In this manner, the glass adhesiveness of the resin composition for a lens can be further improved.

[0126]

(Solvent)

The solvent contained in the resin composition for a lens according to the present embodiment is not particularly limited; however, those that are capable of dissolving each component of the resin composition for a lens are preferably used. Examples of such organic solvents include ketones such as acetone, ethyl methyl ketone, methyl isobutyl ketone, cyclohexanone, and cyclopentanone; aromatic hydrocarbons such as toluene, xylene, methoxybenzene, and tetramethylbenzene; esters such as glycol ethers such as diglyme, dipropylene glycol dimethyl ether, and dipropylene glycol diethyl ether; ethyl lactate, butyl lactate, propyl lactate, ethyl acetate, methyl acetoacetate, ethyl

acetoacetate, methyl propionate, ethyl propionate, propyl propionate, isopropyl propionate, methyl 2-hydroxypropionate, ethyl 2-hydroxypropionate, methyl-3-methoxypropionate, ethyl-3-methoxypropionate, ethyl-3-ethoxypropionate, propyl-3-methoxypropionate, butyl acetate, butyl cellosolve acetate, carbitol acetate, and propylene glycol monomethyl ether acetate; lactones such as α -acetolactone, β -propiolactone, γ -butyrolactone, and δ -valerolactone; alcohols such as methanol, ethanol, cellosolve, and methyl cellosolve; aliphatic hydrocarbons such as octane and decane; and petroleum-based solvents such as petroleum ether, petroleum naphtha, hydrogenated petroleum naphtha, and solvent naphtha.

[0127]

In a case where the resin composition for a lens according to the present embodiment contains a solvent, the content thereof is not particularly limited as long as the effect of the present invention is not impaired, and is, for example, equal to or less than 95% by mass and preferably 10% to 90% by mass in a case where the total amount of all the components of the resin composition for a lens according to the present embodiment is set to 100% by mass.

One kind of the solvent may be used alone, or a plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective solvents is defined as the content of the solvent.

[0128]

In a case where the epoxy compound (Y) is liquid at ordinary temperature (25°C), coating and the like can be suitably carried out even in a case where no solvent is blended or substantially no solvent is blended.

5 [0129]

(Adhesiveness imparting agent)

The adhesive imparting agent contained in the resin composition for a lens according to the present embodiment is not particularly limited, and a known silane coupling agent,
10 titanium coupling agent, or the like can be used. From the viewpoint of improving glass adhesiveness, it is preferable to use a silane coupling agent.

[0130]

Examples of the silane coupling agent include 3-
15 chloropropyltrimethoxysilane, vinyltrichlorosilane, vinyltriethoxysilane, vinyltrimethoxysilane, vinyl tris(2-methoxyethoxy)silane, 3-methacryloxypropyltrimethoxysilane, 2-(3,4-epoxycyclohexyl)ethyltrimethoxysilane, 3-glycidoxypropyltrimethoxysilane, 3-
20 glycidoxypropyltriethoxysilane, 3-glycidoxypropylmethyldimethoxysilane, 3-glycidoxypropylmethyldiethoxysilane, 3-mercaptopropyltrimethoxysilane, and 8-glycidyl-octyltrimethoxysilane.

25 [0131]

In a case where the resin composition for a lens according to the present embodiment contains an adhesiveness imparting

agent, the content of the adhesiveness imparting agent in the resin composition for a lens according to the present embodiment is not particularly limited as long as the effect of the present invention is not impaired, and is preferably equal to or less
5 than 15% by mass, more preferably equal to or less than 10% by mass, still more preferably equal to or less than 5% by mass, even still more preferably equal to or less than 2% by mass, and even still more preferably equal to or less than 1% by mass in the non-volatile component of the resin composition for a lens
10 according to the present embodiment.

In a case where the resin composition for a lens according to the present embodiment contains an adhesiveness imparting agent, the content of the adhesiveness imparting agent in the resin composition for a lens according to the present embodiment
15 is not particularly limited as long as the effect of the present invention is not impaired, and is preferably equal to or more than 0.1% by mass, more preferably equal to or more than 0.5% by mass, and still more preferably equal to or more than 0.8% by mass in the non-volatile component of the resin composition for
20 a lens according to the present embodiment.

One kind of the adhesiveness imparting agent may be used alone, or a plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective adhesiveness imparting
25 agents is defined as the content of the adhesiveness imparting agent.

[0132]

(Polyol compound)

In a case where the resin composition for a lens according to the present embodiment contains a polyol compound, the polyol compound is not particularly limited, but is typically a
5 polyester polyol-based compound containing a hydroxy group that reacts with an epoxy group under the influence of a strong acid catalyst. For example, it is possible to use the polyol compound described in Japanese Examined Patent Publication No. 5901070.

10 [0133]

In a case where the resin composition for a lens according to the present embodiment contains a polyol compound, the content of the polyol compound in the resin composition for a lens according to the present embodiment is not particularly
15 limited as long as the effect of the present invention is not impaired, and is, for example, 1 to 30 parts by mass and preferably 2 to 25 parts by mass with respect to 100 parts by mass of the epoxy compound (Y).

One kind of the polyol compound may be used alone, or a
20 plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective polyol compounds is defined as the content of the polyol compound.

[0134]

25 The polyol compound contained in the resin composition for a lens according to the present embodiment is a compound which can increase the crosslinking density of the epoxy compound by

heating to cure the epoxy compound. For example, it is possible to use the polyvalent phenol compound described in Japanese Examined Patent Publication No. 5967824.

[0135]

5 (Polyvalent phenol compound)

In a case where the resin composition for a lens according to the present embodiment contains a polyhydric phenol compound, the content of the polyhydric phenol compound in the resin composition for a lens according to the present embodiment is
10 not particularly limited as long as the effect of the present invention is not impaired, and is, for example, 3 to 40 parts by mass, preferably 4 to 30 parts by mass, and more preferably 5 to 25 parts by mass with respect to 100 parts by mass of the epoxy compound (Y).

15 One kind of the polyvalent phenol compound may be used alone, or a plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective polyvalent phenol compounds is defined as the content of the polyvalent phenol
20 compound.

[0136]

(Sensitizing agent)

The sensitizing agent contained in the resin composition for a lens according to the present embodiment plays a role in
25 providing the absorbed light energy to the photocationic polymerization initiator. Examples thereof include thioxanthenes and an anthracene compound having an alkoxy group

at the 9-position and the 10-position (a 9,10-dialkoxyanthracene derivative).

[0137]

In a case where the resin composition for a lens according
5 to the present embodiment contains a sensitizer, the content of
the sensitizer in the resin composition for a lens according to
the present embodiment is not particularly limited as long as
the effect of the present invention is not impaired, and is
preferably equal to or less than 30 parts by mass and more
10 preferably equal to or less than 20 parts by mass with respect
to 100 parts by mass of the photocationic polymerization
initiator (X).

In a case where the resin composition for a lens according
to the present embodiment contains a sensitizer, the content of
15 the sensitizer in the resin composition for a lens according to
the present embodiment is not particularly limited as long as
the effect of the present invention is not impaired, and is, for
example, equal to or more than 0.1 parts by mass with respect to
100 parts by mass of the photocationic polymerization initiator
20 (X).

One kind of the sensitizing agent may be used alone, or a
plurality of kinds thereof may be mixed and used. In a case
where a plurality of kinds thereof are mixed and used, a total
of contents of the respective sensitizing agents is defined as
25 the content of the sensitizing agent.

[0138]

(Ion capture)

The ion capture contained in the resin composition for a lens according to the present embodiment can reduce the adverse effects due to ions derived from the photocationic polymerization initiator (X). For example, it is possible to use, as the ion capture, organic aluminum compounds or an onium weak acid salt compound that generates a weak acid upon irradiation with ultraviolet rays.

[0139]

In a case where the resin composition for a lens according to the present embodiment contains an ion catcher, the content of the ion catcher in the resin composition for a lens according to the present embodiment is not particularly limited as long as the effect of the present invention is not impaired. In a case of organic aluminum compounds, the content thereof is preferably 0.1 to 10 parts by mass with respect to 100 parts by mass of the photocationic polymerization initiator (X). In a case of the onium weak acid salt compound, the content thereof is preferably 0.001 to 2 parts by mass with respect to 100 parts by mass of the photocationic polymerization initiator (X).

One kind of the ion capture may be used alone, or a plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective ion captures is defined as the content of the ion capture.

[0140]

(Another photocationic polymerization initiator)

The resin composition for a lens according to the present

embodiment may contain a photocationic polymerization initiator (another photocationic polymerization initiator) other than the photocationic polymerization initiator (X).

The other photocationic polymerization initiator contained
 5 in the resin composition for a lens according to the present embodiment is not particularly limited, and a known photocationic polymerization initiator can be used.

[0141]

Examples of the other photocationic polymerization
 10 initiator include an agent having, as an anion, $[(R_{20})_sB(Phf)_{4-s}]^-$ (in the formula, R_{20} represents a phenyl group or a biphenyl group, Phf represents a phenyl group in which at least one hydrogen atom is substituted with at least one selected from a perfluoroalkyl group, a perfluoroalkoxy group, and a halogen
 15 atom, and s is an integer of 0 to 3), BF_4^- , $[(Rf)_nPF_{6-n}]^-$ (Rf: an alkyl group in which equal to or more than 80% of hydrogen atoms are substituted with a fluorine atom, n : an integer of 0 to 5), AsF_6^- , SbF_6^- , pentafluorohydroxyantimonate, or the like.

[0142]

20 The content of the other photocationic polymerization initiator in the resin composition for a lens according to the present embodiment is not particularly limited as long as the effect of the present invention is not impaired, but is preferably equal to or less than 50 parts by mass, more
 25 preferably equal to or less than 20 parts by mass, and still more preferably equal to or less than 10 parts by mass with respect to 100 parts by mass of the photocationic polymerization

initiator (X).

[0143]

One kind of the other photocationic polymerization initiator may be used alone, or a plurality of kinds thereof may be mixed and used. In a case where a plurality of kinds thereof are mixed and used, a total of contents of the respective other photocationic polymerization initiators is defined as the content of the other photocationic polymerization initiator.

[0144]

10 (Other additives)

The resin composition for a lens according to the present embodiment may contain, in addition to the above components, various additives such as a thermoplastic resin, a colorant, a thickener, an antifoaming agent, and a leveling agent, as necessary.

[0145]

<Manufacturing method>

The resin composition for a lens according to the present embodiment can be obtained by stirring and mixing the above-described respective components by an ordinary method. Alternatively, as necessary, dispersion and mixing may be carried out using a disperser such as a dissolver, a homogenizer, or a three-roll mill. In addition, after mixing, filtration may be further carried out using a mesh, a membrane filter, or the like.

[0146]

<Physical properties>

The viscosity of the resin composition for a lens according to the present embodiment can be measured with, for example, an E-type viscometer.

The lower limit value of the viscosity of the resin composition for a lens according to the present embodiment, which is measured using an E-type viscometer under conditions of a temperature of 25°C and a rotation speed of 2.5 rpm, is preferably equal to or more than 100 mPa·s, more preferably equal to or more than 200 mPa·s, still more preferably equal to or more than 500 mPa·s, and even still more preferably equal to or more than 700 mPa·s. In this manner, the curability of the resin composition for a lens is improved.

In addition, the upper limit value of the viscosity is preferably equal to or less than 5,000 mPa·s, more preferably equal to or less than 3,000 mPa·s, still more preferably equal to or less than 2,000 mPa·s, and even still more preferably equal to or less than 1,500 mPa·s. In this manner, the moldability of the resin composition for a lens is improved.

[0147]

In the resin composition for a lens according to the present embodiment, a refractive index of a cured substance for a lens obtained by applying the resin composition for a lens over a glass plate to have a thickness of 250 μm , exposing the resin composition for a lens to UV under conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the resin composition for a lens in a nitrogen atmosphere under

conditions of 120°C and 30 minutes is preferably equal to or more than 1.55, more preferably equal to or more than 1.56, still more preferably equal to or more than 1.57, even still more preferably equal to or more than 1.58, and even still more
5 preferably equal to or more than 1.59.

In a case where the refractive index of the cured substance for a lens is equal to or greater than the above-described lower limit value, optical characteristics of the lens can be improved.

10 In addition, the upper limit value of the refractive index of the cured substance for a lens is not particularly limited, but is, for example, equal to or less than 1.90, equal to or less than 1.80, equal to or less than 1.75, or equal to or less than 1.70.

15 [0148]

The refractive index of the cured substance for a lens can be measured with an Abbe refractometer.

[0149]

In a cured substance for a lens obtained by applying the
20 resin composition for a lens over a glass plate to have a thickness of 250 μm , exposing the resin composition for a lens to UV under conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the resin composition for a lens in a
25 nitrogen atmosphere under conditions of 120°C and 30 minutes, a lower limit value of a light transmittance in a thickness direction measured by an ultraviolet-visible-near infrared

spectrophotometer under the following (Measurement conditions)
is preferably equal to or more than 70%, more preferably equal
to or more than 75%, still more preferably equal to or more than
80%, and even more preferably equal to or more than 82%. In
5 this manner, a lens having higher transparency can be
manufactured.

In addition, the upper limit value of the light
transmittance is not particularly limited, but is, for example,
equal to or less than 100%.

10 [0150]

(Measurement conditions)

Measurement method: transmission method

Measurement wavelength: 400 nm

Reference: atmosphere

15 Detector: integrating sphere/photomultiplier tube (200 nm
to 850 nm)

Integrating sphere: PbS (850 nm to 2,600 nm)

[0151]

In the resin composition for a lens according to the
20 present embodiment, in a cured substance for a lens obtained by
applying the resin composition for a lens over a glass plate to
have a thickness of 250 μm , exposing the resin composition for a
lens to UV under conditions of a wavelength of 365 nm, an
irradiation intensity of 500 mW/cm, and an integrated
25 irradiation dose of 6000 mJ/cm², and heating the resin
composition for a lens in a nitrogen atmosphere under conditions
of 120°C and 30 minutes, a lower limit value of a light

transmittance (after the heat resistance test) in a thickness direction, which is measured under the following (measurement conditions) using an ultraviolet-visible-near infrared spectrophotometer after performing a heat resistance test by
5 heating the cured substance for a lens in an oven set at 125°C in an air atmosphere for 168 hours, is preferably equal to or more than 70%, more preferably equal to or more than 72%, still more preferably equal to or more than 74%, even still more preferably equal to or more than 76%, even still more preferably
10 equal to or more than 78%, and even still more preferably equal to or more than 79%. In this manner, a lens having higher transparency can be manufactured.

In addition, the upper limit value of the light transmittance (after the heat resistance test) is not
15 particularly limited, but is, for example, equal to or less than 100%.

[0152]

(Measurement conditions)

Measurement method: transmission method

20 Measurement wavelength: 400 nm

Reference: atmosphere

Detector: integrating sphere/photomultiplier tube (200 nm to 850 nm)

Integrating sphere: PbS (850 nm to 2,600 nm)

25 [0153]

<Use application>

The resin composition for a lens according to the present

embodiment is suitably used for a wafer-level lens.

[0154]

The wafer-level lens is a lens that is manufactured by making several lenses on a wafer-shaped resin (a wafer-level lens array) at the same time and cutting the lenses.

FIG. 1 is a plan view showing an example of a configuration of a wafer-level lens array having a plurality of wafer-level lenses. As shown in FIG. 1, a wafer-level lens array 1 includes a substrate 2 and a plurality of lenses 10 arranged on the substrate 2. The plurality of lenses 10 are formed to be arranged in one-dimensional or two-dimensional manner with respect to the substrate 2. The lenses 10 formed on the wafer-level lens array 1 are subsequently cut one by one.

[0155]

Therefore, the wafer-level lens has the advantage that several hundred or more lenses can be produced at one time, which provides excellent production efficiency.

[0156]

Further, the wafer-level lens also has the advantage that it is possible to manufacture a lens that pursues thinness and smallness, which is limited in the injection molding. The size of the wafer-level lens is, for example, about 1 to 10 mm in diameter and about 100 to 2,000 μm in thickness, and by utilizing this size, the wafer-level lens is suitably used in a camera of an electronic instrument such as a smartphone, a tablet terminal, or a laptop.

[0157]

The resin composition for a lens according to the present embodiment can form a cured substance for a lens having an improved performance balance of a high refractive index, a high light transmittance, high heat resistance, and high bleed-out resistance, and thus is suitably used for a wafer-level lens that is required to be thin and small.

[0158]

[Cured substance for lens]

The cured substance for a lens according to the present embodiment can be obtained by curing the above-described resin composition for a lens.

In addition, since the wafer-level lens and the like, which include the cured substance for a lens according to the present embodiment, are mounted on the circuit board, the cured substance for a lens according to the present embodiment may be subjected to a reflow treatment in a temperature environment of equal to or higher than 30°C and equal to or lower than 300°C.

[0159]

The glass transition temperature (T_g) of the cured substance for a lens of the present embodiment according to the following (method) is preferably equal to or higher than 70°C and equal to or lower than 200°C, more preferably equal to or higher than 70°C and equal to or lower than 180°C, still more preferably equal to or higher than 80°C and equal to or lower than 160°C, even still more preferably equal to or higher than 90°C and equal to or lower than 140°C, and even still more preferably equal to or higher than 100°C and equal to or lower

than 120°C.

[0160]

(Method)

The resin composition for a lens is added dropwise over a
 5 PDMS substrate (120 × 80 × 1 mm) and sandwiched between the
 same PDMS substrates as described above with a silicone spacer
 having a thickness of 250 μm, and fixed with a clip. On the
 other hand, the resin composition for a lens is cured by UV
 exposure using a metal halide lamp such that the irradiation
 10 intensity in UVA is 500 mW/cm and the integrated irradiation
 dose is 6,000 mJ/cm².

Subsequently, the cured resin composition for a lens is
 released from the PDMS substrate and heated at 120°C for 30
 minutes in a nitrogen atmosphere to obtain a cured substance for
 15 a lens before a reflow treatment.

Next, a reflow heating treatment is performed on the cured
 substance for a lens before the reflow treatment under the
 conditions shown in Table 1 below to obtain a cured substance
 for a lens after the reflow treatment.

20 Thereafter, the solid viscoelasticity of the cured
 substance for a lens after the reflow treatment is measured
 under the following conditions.

Device: RSA-G2 (manufactured by TA Instruments)

Deformation mode: tensile

25 Temperature range: -50°C to 180°C

Temperature rising rate: 3°C/min

Frequency: 1 Hz

Environment: N₂ atmosphere

Then, from the measurement result of the viscoelasticity, the temperature at which the value of $\tan \delta$ shows the maximum value is measured as T_g.

5 [0161]

[Table 1]

Table 1

Step	Gradient time s	Heating temperature °C	Holding time s	N ₂ flow rate L/m
1	-	40	300	30
2	-	160	1	30
3	90	180	1	30
4	1	260	10	30
5	1	100	1	30

[0162]

The refractive index of the cured substance for a lens according to the present embodiment is preferably equal to or
 10 more than 1.55, more preferably equal to or more than 1.56, still more preferably equal to or more than 1.57, even still more preferably equal to or more than 1.58, and even still more preferably equal to or more than 1.59. The refractive index can be obtained by the above-described procedure as a procedure for
 15 measuring the refractive index of the cured substance for a lens.

In addition, the upper limit value of the refractive index of the cured substance for a lens is not particularly limited, but is, for example, equal to or less than 1.90, equal to or
 20 less than 1.80, equal to or less than 1.75, or equal to or less than 1.70.

[0163]

The lower limit value of the light transmittance (before the heat resistance test) of the cured substance for a lens according to the present embodiment in the thickness direction is preferably equal to or more than 70%, more preferably equal to or more than 75%, still more preferably equal to or more than 80%, and even more preferably equal to or more than 82%. The light transmittance can be determined according to the above-described procedure as a procedure for measuring the light transmittance of the cured substance for a lens.

In addition, the upper limit value of the light transmittance is not particularly limited, but is, for example, equal to or less than 100%.

[0164]

Since the cured substance for a lens according to the present embodiment has an improved performance balance of a high refractive index, a high light transmittance, high heat resistance, and high bleed-out resistance, the cured substance for a lens according to the present embodiment is suitably used for a wafer-level lens that is required to be thin and small.

[0165]

[Lens]

The lens according to the present embodiment includes the above-described cured substance for a lens.

[0166]

The lens according to the present embodiment can be manufactured by, for example, imprinting. The imprint molding

is a processing technique of sandwiching a resin composition for a lens between lens molding dies and transferring a pattern.

The resin composition for a lens, which is sandwiched between the lens molding dies is cured by heating or light irradiation.

5 [0167]

The light irradiation can be carried out by using, for example, a mercury lamp, a xenon lamp, a carbon arc lamp, a metal halide lamp, sunlight, an electron beam source, a laser light source, an LED light source, or the like, and carrying out
10 irradiation so that the integrated irradiation dose is, for example, in a range of 500 to 5,000 mJ/cm².

[0168]

The resin composition for a lens (the cured substance for a lens), which is sandwiched between lens molding dies, may be
15 used as it is as a lens; however, the cured substance for a lens may be laminated with another material.

Examples of the other material to be laminated with the cured substance for a lens include glass. Since there are many kinds of glass, and a glass having a high refractive index can
20 be selected, the glass is suitable as a lens material that requires high optical characteristics. In addition, the glass has an advantage that heat resistance is excellent.

In addition, a resin may be used. The resin has excellent processability and is suitable for forming a lens easily and at
25 a low cost.

[0169]

In addition, in a case where a wafer-level molding die is

used as the lens molding die, a wafer-level lens array is obtained, and the obtained wafer-level lens array is cut one by one to obtain lenses. The wafer-level lens array is as described above.

5 [0170]

The lens of the present embodiment is suitably used as a wafer-level lens in which a thin and small size is appealing since the performance balance of high refractive index, high light transmittance, high heat resistance, and high bleed-out resistance is improved.

[0171]

The diameter of the wafer-level lens is, for example, 1 to 10 mm and preferably 1 to 5 mm. In addition, the thickness of the wafer-level lens is, for example, 100 to 2000 μm , and preferably 100 to 1000 μm .

[0172]

The wafer-level lens is suitably used in a camera of an electronic instrument such as a smartphone, a tablet terminal, or a laptop.

20 [0173]

The embodiments according to the present invention have been described above. However, these are examples of the present invention, and various configurations other than the above can be adopted.

25 In addition, the present invention is not limited to the above-described embodiments and thus includes modifications and improvements within a range which makes it possible to achieve

the object of the present invention.

Examples

[0174]

Hereinafter, the present embodiment according to the
 5 present invention will be described in detail based on Examples.
 However, the present embodiment according to the present
 invention is not limited to these Examples.

[0175]

<Preparation of resin composition for lens>

10 The raw materials described in Table 3 were stirred and
 mixed at 50°C until uniform to obtain a resin composition for a
 lens of each of Examples and Comparative Examples.

The raw materials described in Table 3 are as follows.

[0176]

15 · Photocationic polymerization initiator (X):
 triarylsulfonium-tetrakis-pentafluorophenylgalate, manufactured
 by San-Apro Ltd., product name: CPI-310FG

· Photocationic polymerization initiator:
 thiophenyldiphenylsulfonium tris(pentafluoroethyl)
 20 trifluorophosphate, manufactured by San-Apro Ltd., product name:
 CPI-210S

[0177]

· Epoxy compound (Y): bisphenol A type epoxy resin,
 manufactured by DIC Corporation, product name: EXA-850CRP, epoxy
 25 equivalent: 158 to 168 g/eq

[0178]

· Monofunctional epoxy compound (Z): o-phenylphenol

glycidyl ether, manufactured by Yokkaichi Chemical Co., Ltd.,
product name: OPP-EP

[0179]

- Oxetane compound (W): biphenyl-type oxetane compound
5 (xylene bisoxetane), manufactured by Toagosei Co., Ltd., product
name: ARON OXETANE OXT-121

[0180]

- Adhesivity imparting agent: silane coupling agent (3-
glycidoxypropyltrimethoxysilane), manufactured by Shin-Etsu
10 Chemical Co., Ltd., product name: KBM-403

[0181]

- Antioxidant: phenol-based antioxidant (pentaerythritol
tetrakis[3-(3,5-di-tert-butyl-4-hydroxyphenyl)propionate]),
manufactured by ADEKA Corporation, product name: ADEKA STAB AO-
15 60

[0182]

- Light stabilizer 1: hindered amine-based light stabilizer
(bis[2,2,6,6-tetramethyl-1-(undecyloxy)piperidin-4-
yl]=carbonate), manufactured by ADEKA CORPORATION, product name:
20 ADEKA STAB LA-81, base dissociation constant pKb: 11.3

- Light stabilizer 2: hindered amine-based light stabilizer
(bis(1,2,2,6,6-pentamethyl-4-piperidyl) sebacate), manufactured
by ADEKA CORPORATION, product name: ADEKA STAB LA-72, base
dissociation constant pKb: 5.8

- 25 · Light stabilizer 3: hindered amine-based light stabilizer
(bis[1-(octyloxy)-2,2,6,6-tetramethyl-4-piperidinyl] sebacate),
manufactured by BASF SE, product name: Tinuvin 123, base

dissociation constant pK_b: 11.5

· Light stabilizer 4: hindered amine-based light stabilizer
(2-[[4,6-bis[butyl[1-(cyclohexyloxy)-2,2,6,6-
tetramethylpiperidin-4-yl]amino]-1,3,5-triazine-2-

5 yl]amino]ethanol), manufactured by BASF SE, product name:
Tinuvin 152, base dissociation constant pK_b: 10.6

· Light stabilizer 5: hindered amine-based light stabilizer
(bis(2,2,6,6-tetramethyl-4-piperidyl-1-oxyl) sebacate),
manufactured by Tokyo Chemical Industry Co., Ltd., base

10 dissociation constant pK_b: 10.1

[0183]

<Base dissociation constant pK_b>

The base dissociation constant pK_b of each light stabilizer
was measured by the following method.

15 0.1 g of each of the light stabilizers is dissolved in 100
g of an 80% by mass methanol-containing aqueous solution, and
the solution is measured with a pH meter (manufactured by
Horiba, Ltd.) while being titrated with a 3 N-HCl aqueous
solution to obtain a pH titration curve. The pK_b value is
20 calculated by a graphical method using the obtained pH titration
curve.

[0184]

<Viscosity>

Using an E-type viscometer (TVE-25L, manufactured by TOKI
25 SANGYO Co., Ltd.), the viscosity of the resin composition for a
lens of each of Examples and Comparative Examples was measured
under conditions of a temperature of 25°C and a rotation speed

of 2.5 rpm. A cone plate was appropriately selected from 1°34' × R24, 3° × R14, and 3° × R9.7 depending on the viscosity of the sample. Table 3 shows the results.

[0185]

5 <Production of cured substance 1 for lens>

The resin composition for a lens was added dropwise over a PDMS substrate (120 × 80 × 1 mm, manufactured by DuPont-Toray Specialty Materials K.K.), and the PDMS substrate was sandwiched between the same PDMS substrates as described above with a
10 silicone spacer having a thickness of 250 μm, and fixed with a clip. On the other hand, the resin composition for a lens was cured by UV exposure using a metal halide lamp such that the irradiation intensity in UVA was 500 mW/cm and the integrated irradiation dose was 6,000 mJ/cm².

15 Subsequently, the cured resin composition for a lens was released from the PDMS substrate and heated at 120°C for 30 minutes in a nitrogen atmosphere to obtain a cured substance 1 for a lens before a reflow treatment.

[0186]

20 <Reflow treatment>

The cured substance 1 for a lens before the reflow treatment in each of Examples and Comparative Examples was subjected to a reflow heating treatment under the conditions shown in Table 2 below using a desktop heating furnace device
25 (SV0-1, manufactured by Shin Apex Co., Ltd.) to obtain a cured substance 1 for a lens after the reflow treatment.

[0187]

[Table 2]

Table 2

Step	Gradient time s	Heating temperature °C	Holding time s	N ₂ flow rate L/m
1	-	40	300	30
2	-	160	1	30
3	90	180	1	30
4	1	260	10	30
5	1	100	1	30

[0188]

<Measurement of refractive index>

The refractive index of the cured substance 1 for a lens
 5 after the reflow treatment in each of Examples and Comparative
 Examples was measured using an Abbe refractometer (DR-M2,
 manufactured by Atago Co., Ltd.). A sample temperature was set
 to 25°C, and measurement was carried out using RE-3520 (589 nm,
 D line, manufactured by ATAGO Co., Ltd.) as an interference
 10 filter and RE-1196 (monobromonaphthalene, manufactured by ATAGO
 Co., Ltd.) as an intermediate solution. Table 3 shows the
 results.

[0189]

<Measurement of glass transition temperature (T_g)>

15 The solid viscoelasticity of the cured substance 1 for a
 lens after the reflow treatment in each of Examples and
 Comparative Examples was measured under the following
 conditions.

Device: RSA-G2 (manufactured by TA Instruments)

20 Deformation mode: tensile

Temperature range: -50°C to 180°C

Temperature rising rate: 3°C/min

Frequency: 1 Hz

Environment: N₂ atmosphere

[0190]

5 Then, from the measurement result of the viscoelasticity, the temperature at which the value of $\tan\delta$ showed the maximum value was measured as T_g.

[0191]

<Production of cured substance 2 for lens>

10 The resin composition for a lens was added dropwise over a PDMS substrate (120 × 80 × 1 mm, manufactured by DuPont-Toray Specialty Materials Co., Ltd.) and sandwiched between borosilicate glass substrates (D263t eco, 120 × 80 × 0.2 mm, manufactured by SCHOTT AG) through a silicone spacer having a
15 thickness of 250 μm and fixed with a clip. On the other hand, the resin composition for a lens was cured by UV exposure using a metal halide lamp such that the irradiation intensity in UVA was 500 mW/cm and the integrated irradiation dose was 6,000 mJ/cm².

20 Subsequently, the cured resin composition for a lens was released from the PDMS substrate and heated at 120°C for 30 minutes in a nitrogen atmosphere to obtain a cured substance 2 for a lens before the reflow treatment.

[0192]

25 <Reflow treatment>

The cured substance 2 for a lens before the reflow treatment in each of Examples and Comparative Examples was

subjected to a reflow heating treatment under the conditions shown in Table 2 above using a desktop heating furnace device (SV0-1, manufactured by Shin Apex Co., Ltd.) to obtain a cured substance 2 for a lens after the reflow treatment.

5 [0193]

<Light transmittance>

In each of Examples and Comparative Examples, the light transmittance of the cured substance 2 for a lens in the thickness direction after the reflow treatment was measured
10 under the following (measurement conditions) to obtain the light transmittance before the heat resistance test. The measurement was performed by attaching the cured substance 2 for a lens to an integrating sphere, and the light incident surface was a glass surface. Table 3 shows the results.

15 (Measurement conditions)

Measurement device: UH4150 (ultraviolet-visible near-infrared spectrophotometer, manufactured by Hitachi High-Tech Science Corporation)

Measurement method: transmission method

20 Measurement wavelength: 400 nm

Reference: atmosphere

Detector: integrating sphere/photomultiplier tube (200 nm to 850 nm)

Integrating sphere: PbS (850 nm to 2,600 nm)

25 [0194]

<Light Transmittance after Heat Resistance Test>First, a heat resistance test was performed by heating the cured

substance 2 for a lens after the reflow treatment in an air atmosphere in an oven set at 125°C for 168 hours. For the cured substance 2 for a lens after the heat resistance test, the light transmittance in the thickness direction was measured under the
5 above-described conditions to obtain the light transmittance after the heat resistance test. Table 3 shows the results.

[0195]

<Evaluation of presence or absence of foreign matter>

In each of Examples and Comparative Examples, the presence
10 or absence of foreign matter was observed at a magnification of 50 times using a 3D measurement laser microscope (LEXT OLS5000, manufactured by Olympus Corporation) for the resin surface of the cured substance 2 for a lens before and after the reflow treatment and the cured substance 2 for a lens after the heat
15 resistance test obtained in <Light Transmittance after Heat Resistance Test>. In this case, it was determined that foreign matter was generated in a case where equal to or more than 10 protruding components having a diameter of equal to or more than 1.0 μm and a height of equal to or more than 50 nm were
20 confirmed within an observation range of 250 μm square. Table 3 shows the results.

[0196]

[Table 3]

Table 3

			Example 1	Example 2	Example 3	Example 4	Example 5	Example 6	Example 7	Example 8	Example 9	Comparative Example 1	Comparative Example 2	Comparative Example 3
Photocationic polymerization initiator (X)	Parts by mass		1	3	1	1	1	1	1	3	3	1		
Photocationic polymerization initiator/CPI-210S	Parts by mass												1	1
Epoxy compound (Y)	Parts by mass		60	55	60	60	60	60	60	55	55	60	60	60
Monofunctional epoxy compound (Z)	Parts by mass		40	40	40	40	40	40	40	40	40	40	40	40
Oxetane compound (W)	Parts by mass			5						5	5			
Adhesiveness imparting agent	Parts by mass		1	1	1	1	1	1	1	1	1	1	1	1
Antioxidant	Parts by mass		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
Light stabilizer 1	Parts by mass		0.1	0.1				0.5	1				0.1	
Light stabilizer 2	Parts by mass											0.1		0.1
Light stabilizer 3	Parts by mass				0.1					0.1				
Light stabilizer 4	Parts by mass					0.1					0.1			
Light stabilizer 5	Parts by mass						0.1							
Viscosity (25°C)	mPa·s		1200	1000	1200	1200	1200	1200	1200	1000	1000	1200	1200	1200
Refractive index	-		1.60	1.59	1.60	1.60	1.60	1.60	1.60	1.59	1.59	1.59	1.60	1.60
Tg		°C	110	100	110	110	110	110	110	100	100	100	105	105
Light transmittance	Before heat resistance test	%	82.7	83.6	83.0	82.5	82.0	83.5	83.6	81.9	82.1	80.0	78.8	74.5
	After heat resistance test	%	79.0	81.5	79.8	79.9	78.8	81.2	82.0	80.9	79.4	82.7	43.2	32.5
Presence or absence of foreign matter	Before reflow treatment	-	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent
	After reflow treatment	-	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent
	After heat resistance test	-	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Absent	Present	Absent	Absent

[0197]

In each example, the generation of foreign matter was not confirmed, while in Comparative Example 1, the generation of

foreign matter was confirmed. This indicates that the occurrence of bleed-out during ultraviolet curing and heating is suppressed in the resin composition of each example. In addition, the refractive index and the light transmittance of each example were at a high level comparable to that of Comparative Example 1. Meanwhile, it was found that in Comparative Examples 2 and 3 which did not contain the specific photocationic polymerization initiator (X), the light transmittance after the heat resistance test was reduced, and the heat resistance was deteriorated. From these, it can be seen that the performance balance of the resin composition for a lens of Examples is improved in terms of high refractive index, high light transmittance, high heat resistance, and bleed-out resistance, as compared with the resin composition for a lens of Comparative Examples.

[0198]

The present application claims priority based on Japanese Patent Application No. 2023-107856 filed on June 30, 2023, the entire content of which is incorporated herein by reference.

The present invention also includes the following aspects.

1. A resin composition for a lens including:

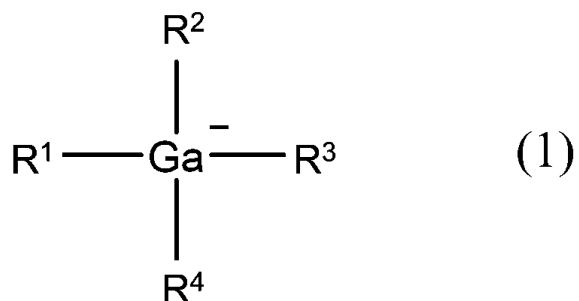
a photocationic polymerization initiator (X) containing a salt formed of an anion represented by General Formula (1) and a cation;

an epoxy compound (Y) containing equal to or more than two epoxy groups in a molecule; and

a stabilizer including a partial structure represented by

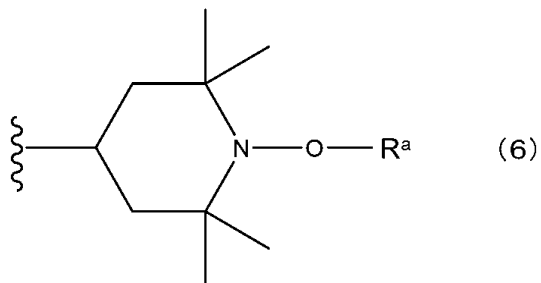
General Formula (6),

[chem. 27]



(in General Formula (1), R¹ to R⁴ each independently
5 represent an alkyl group having 1 to 18 carbon atoms or an aryl
group having 6 to 14 carbon atoms,

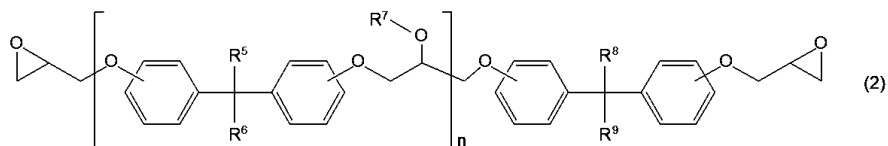
[chem. 28]



(in General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms).

2. The resin composition for a lens according to 1.,
in which the epoxy compound (Y) is represented by General
Formula (2),

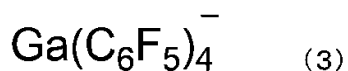
15 [chem. 29]



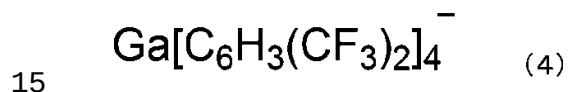
(in General Formula (2), R⁵, R⁶, R⁸, and R⁹ each independently represent a hydrogen atom, an alkyl group having 1 to 4 carbon atoms, or a trifluoromethyl group, R⁷'s each independently represent a hydrogen atom or a glycidyl group, and
 5 n is an average repetition number, where n represents a real number in a range of 0 to 30).

3. The resin composition for a lens according to 1. or 2., in which the photocationic polymerization initiator (X) includes, as an anion, at least one selected from an anion
 10 represented by Formula (3) or an anion represented by Formula (4).

[chem. 30]



[chem. 31]



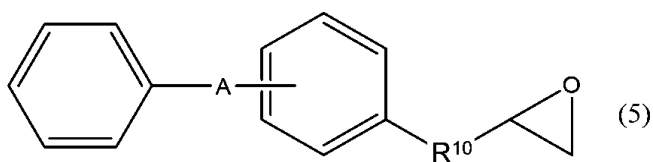
4. The resin composition for a lens according to any one of 1. to 3.,

in which the photocationic polymerization initiator (X) contains a sulfonium ion as the cation.

20 5. The resin composition for a lens according to any one of 1. to 4., further including:

a monofunctional epoxy compound (Z) represented by General Formula (5),

[chem. 32]



(in General Formula (5), A is selected from a single bond, an oxygen atom, and a sulfur atom, R^{10} is an alkylene having 1 to 8 carbon atoms, and any methylene group may be substituted with an oxygen atom).

6. The resin composition for a lens according to 5., in which the monofunctional epoxy compound (Z) contains o-phenylphenol glycidyl ether.

7. The resin composition for a lens according to any one of 1. to 6., further including:

an oxetane compound (W).

8. The resin composition for a lens according to 7., in which the oxetane compound (W) contains a biphenyl type oxetane compound.

9. The resin composition for a lens according to any one of 1. to 8.,

in which in a case where the resin composition for a lens is subjected to a measurement with an E-type viscometer under conditions of a temperature of 25°C and a rotation speed of 2.5 rpm, a viscosity of the resin composition for a lens is equal to or more than 100 mPa·s and equal to or less than 5,000 mPa·s.

10. The resin composition for a lens according to any one of 1. to 9.,

in which a refractive index of a cured substance obtained by applying the resin composition for a lens over a glass

substrate to have a thickness of 250 μm , subjecting the applied composition to UV exposure under conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the composition
5 under a nitrogen atmosphere at 120°C for 30 minutes is equal to or more than 1.55.

11. The resin composition for a lens according to any one of 1. to 10.,

in which a light transmittance in a thickness direction of
10 a cured substance obtained by applying the resin composition for a lens over a glass substrate to have a thickness of 250 μm , subjecting the applied composition to UV exposure under conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm²,
15 and heating the composition in a nitrogen atmosphere at 120°C for 30 minutes is equal to or more than 70%, which is measured under the following (Measurement conditions) using an ultraviolet-visible-near infrared spectrophotometer,

(Measurement conditions)

20 measurement method: transmission method,

measurement wavelength: 400 nm,

reference: atmosphere,

detector: integrating sphere/photomultiplier tube (200 nm to 850 nm),

25 integrating sphere: PbS (850 nm to 2,600 nm).

12. The resin composition for a lens according to any one of 1. to 11.,

in which a light transmittance in a thickness direction of a cured substance obtained by applying the resin composition for a lens over a glass substrate to have a thickness of 250 μm , subjecting the applied composition to UV exposure under
5 conditions of a wavelength of 365 nm, an irradiation intensity of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the composition in a nitrogen atmosphere at 120°C for 30 minutes is equal to or more than 70%, which is measured under the following (Measurement conditions) after the following
10 (heat resistance test) using an ultraviolet-visible-near infrared spectrophotometer,

(Measurement conditions)

Measurement method: transmission method,

Measurement wavelength: 400 nm,

15 Reference: atmosphere,

Detector: integrating sphere/photomultiplier tube (200 nm to 850 nm),

Integrating sphere: PbS (850 nm to 2,600 nm),

(Heat resistance test)

20 the cured substance is heated in an oven set at 125°C for 168 hours in an air atmosphere.

13. The resin composition for a lens according to any one of 1. to 12.,

in which the resin composition for a lens is used for a
25 wafer-level lens.

14. A cured substance for a lens, which is obtained by curing the resin composition for a lens according to any one of

1. to 13..

15. A lens including:

the cured substance for a lens according to 14..

5 REFERENCE SIGNS LIST

[0199]

1 wafer-level lens array

2 substrate

10 lens

CLAIMS

[Claim 1]

A resin composition for a lens comprising:

5 a photocationic polymerization initiator (X) containing a salt formed of an anion represented by General Formula (1) and a cation;

an epoxy compound (Y) containing equal to or more than two epoxy groups in a molecule; and

10 a stabilizer having a base dissociation constant pK_b of equal to or more than 6.0, which is measured according to <Method for measuring base dissociation index pK_b >,

<Method for measuring base dissociation index pK_b >

0.1 g of a stabilizer is dissolved in 100 g of an 80% by
15 mass methanol-containing aqueous solution, and the solution is measured with a pH meter while being titrated with a 3 N-HCl aqueous solution to obtain a pH titration curve, and the pK_b value is calculated by a graphical method using the obtained pH titration curve.

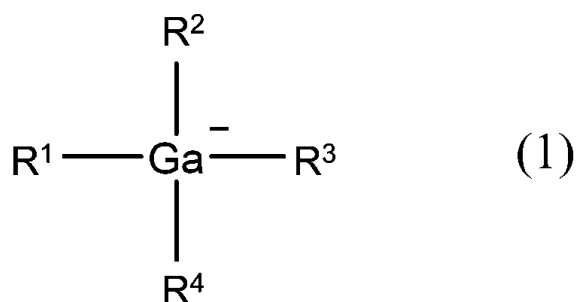
20

[Claim 2]

The resin composition for a lens according to Claim 1,

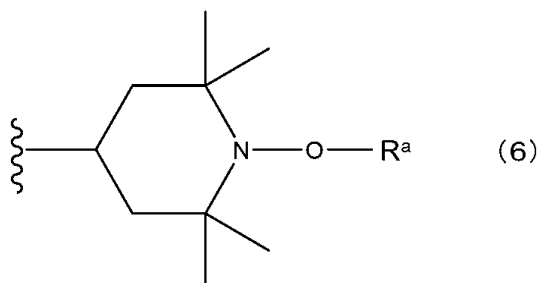
wherein the stabilizer includes a stabilizer including a partial structure represented by one or equal to or more than
25 two selected from the group consisting of a partial structure represented by General Formula (6) and a partial structure represented by General Formula (7),

[chem. 1]



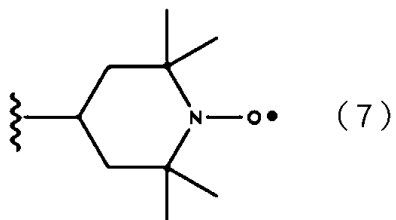
(in General Formula (1), R¹ to R⁴ each independently represent an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms,

[chem. 2]



(in General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms),

[chem. 3]



(in General Formula (7), O• represents an oxyl group).

The resin composition for a lens according to Claim 1 or 2,
wherein the base dissociation constant pK_b of the
stabilizer is equal to or less than 12.0.

5 [Claim 4]

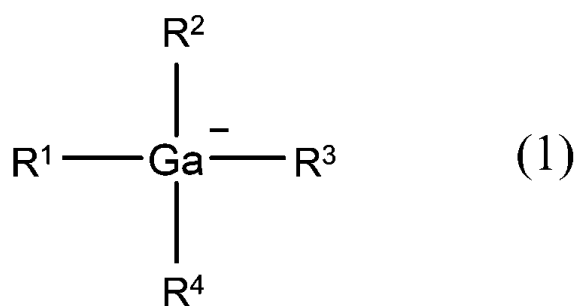
A resin composition for a lens comprising:

a photocationic polymerization initiator (X) containing a
salt formed of an anion represented by General Formula (1) and a
cation;

10 an epoxy compound (Y) containing equal to or more than two
epoxy groups in a molecule; and

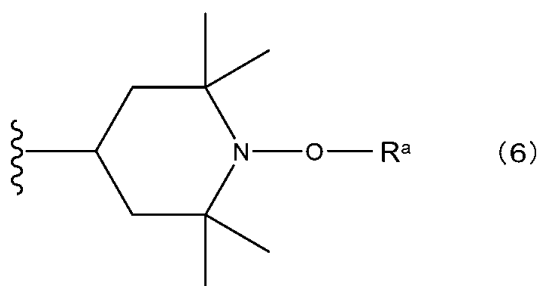
a stabilizer including one or equal to or more than two
kinds of partial structures selected from the group consisting
of a partial structure represented by General Formula (6) and a
15 partial structure represented by General Formula (7),

[chem. 4]



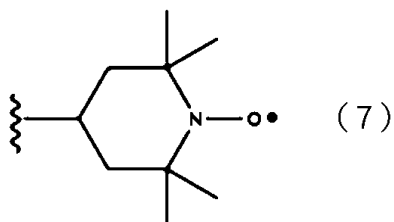
(in General Formula (1), R¹ to R⁴ each independently
represent an alkyl group having 1 to 18 carbon atoms or an aryl
20 group having 6 to 14 carbon atoms,

[chem. 5]



(in General Formula (6), R^a represents an alkyl group having 1 to 18 carbon atoms or an aryl group having 6 to 14 carbon atoms),

5 [chem. 6]



(in General Formula (7), $O\cdot$ represents an oxyl group).

[Claim 5]

10 The resin composition for a lens according to any one of Claims 1 to 4,

wherein a content of the stabilizer is equal to or more than 0.01 parts by mass and equal to or less than 5.0 parts by mass with respect to 100 parts by mass of the epoxy compound

15 (Y).

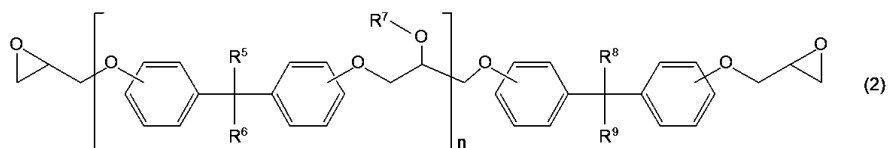
[Claim 6]

The resin composition for a lens according to any one of Claims 1 to 5,

20 wherein the epoxy compound (Y) is represented by General

Formula (2),

[chem. 7]



(in General Formula (2), R⁵, R⁶, R⁸, and R⁹ each

5 independently represent a hydrogen atom, an alkyl group having 1 to 4 carbon atoms, or a trifluoromethyl group, R⁷'s each independently represent a hydrogen atom or a glycidyl group, and n is an average repetition number, where n represents a real number in a range of 0 to 30).

10

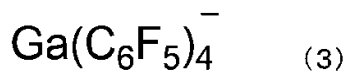
[Claim 7]

The resin composition for a lens according to any one of Claims 1 to 6,

wherein the photocationic polymerization initiator (X)

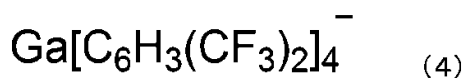
15 includes, as an anion, at least one selected from an anion represented by Formula (3) or an anion represented by Formula (4).

[chem. 8]



20

[chem. 9]



[Claim 8]

The resin composition for a lens according to any one of Claims 1 to 7,

wherein the photocationic polymerization initiator (X) contains a sulfonium ion as the cation.

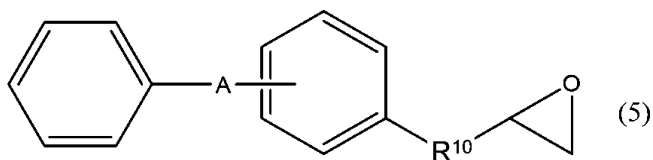
5

[Claim 9]

The resin composition for a lens according to any one of Claims 1 to 8, further comprising:

a monofunctional epoxy compound (Z) represented by General
10 Formula (5),

[chem. 10]



(in General Formula (5), A is selected from a single bond, an oxygen atom, and a sulfur atom, R^{10} is an alkylene having 1 to
15 8 carbon atoms, and any methylene group may be substituted with an oxygen atom).

[Claim 10]

The resin composition for a lens according to Claim 9,
20 wherein the monofunctional epoxy compound (Z) contains o-phenylphenol glycidyl ether.

[Claim 11]

The resin composition for a lens according to any one of
25 Claims 1 to 10, further comprising:

an oxetane compound (W).

[Claim 12]

The resin composition for a lens according to Claim 11,
5 wherein the oxetane compound (W) contains a biphenyl type
oxetane compound.

[Claim 13]

The resin composition for a lens according to any one of
10 Claims 1 to 12,

 wherein in a case where the resin composition for a lens is
subjected to a measurement with an E-type viscometer under
conditions of a temperature of 25°C and a rotation speed of 2.5
rpm, a viscosity of the resin composition for a lens is equal to
15 or more than 100 mPa·s and equal to or less than 5,000 mPa·s.

[Claim 14]

The resin composition for a lens according to any one of
Claims 1 to 13,

20 wherein a refractive index of a cured substance obtained by
applying the resin composition for a lens over a glass substrate
to have a thickness of 250 μm , subjecting the applied
composition to UV exposure under conditions of a wavelength of
365 nm, an irradiation intensity of 500 mW/cm, and an integrated
25 irradiation dose of 6000 mJ/cm², and heating the composition
under a nitrogen atmosphere at 120°C for 30 minutes is equal to
or more than 1.55.

[Claim 15]

The resin composition for a lens according to any one of Claims 1 to 14,

5 wherein a light transmittance in a thickness direction of a cured substance obtained by applying the resin composition for a lens over a glass substrate to have a thickness of 250 μm ,
subjecting the applied composition to UV exposure under conditions of a wavelength of 365 nm, an irradiation intensity
10 of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm², and heating the composition in a nitrogen atmosphere at 120°C for 30 minutes is equal to or more than 70%, which is measured under the following (Measurement conditions) using an ultraviolet-visible-near infrared spectrophotometer,

15 (Measurement conditions)

measurement method: transmission method,

measurement wavelength: 400 nm,

reference: atmosphere,

20 detector: integrating sphere/photomultiplier tube (200 nm to 850 nm),

integrating sphere: PbS (850 nm to 2,600 nm).

[Claim 16]

The resin composition for a lens according to any one of
25 Claims 1 to 15,

wherein a light transmittance in a thickness direction of a cured substance obtained by applying the resin composition for a

lens over a glass substrate to have a thickness of 250 μm ,
subjecting the applied composition to UV exposure under
conditions of a wavelength of 365 nm, an irradiation intensity
of 500 mW/cm, and an integrated irradiation dose of 6000 mJ/cm²,
5 and heating the composition in a nitrogen atmosphere at 120°C
for 30 minutes is equal to or more than 70%, which is measured
under the following (Measurement conditions) after the following
(heat resistance test) using an ultraviolet-visible-near
infrared spectrophotometer,

10 (Measurement conditions)

Measurement method: transmission method,

Measurement wavelength: 400 nm,

Reference: atmosphere,

Detector: integrating sphere/photomultiplier tube (200 nm

15 to 850 nm),

Integrating sphere: PbS (850 nm to 2,600 nm),

(Heat resistance test)

the cured substance is heated in an oven set at 125°C for
168 hours in an air atmosphere.

20

[Claim 17]

The resin composition for a lens according to any one of
Claims 1 to 16,

wherein the resin composition for a lens is used for a
25 wafer-level lens.

[Claim 18]

A cured substance for a lens, which is obtained by curing the resin composition for a lens according to any one of Claims 1 to 17.

5 [Claim 19]

A lens comprising:

the cured substance for a lens according to Claim 18.