

**CHEMICALLY-AMPLIFIED POSITIVE-TYPE PHOTSENSITIVE RESIN
COMPOSITION, METHOD FOR MANUFACTURING COMPOSITE SUBSTRATE
WITH CASTING MOLD, AND METHOD FOR MANUFACTURING
ELECTROPLATED MOLDED ARTICLE**

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FIELD

[0001] The present disclosure relates to a resin composition, a method for manufacturing a composite substrate with a casting mold, and a method for manufacturing an electroplated molded article, and more particularly relates to a chemically-amplified positive-type photosensitive resin composition, a method for manufacturing a composite substrate with a casting mold made from the chemically-amplified positive-type photosensitive resin composition, and a method for manufacturing an electroplated molded article made from the composite substrate with the casting mold.

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BACKGROUND

[0002] Photoelectric processing is a general term describing the technology used for manufacturing various precision components, such as semiconductor packages, and involves coating a photoresist composition on a

surface of a workpiece to form a photoresist layer, patterning the photoresist layer by photolithography technique to obtain a patterned photoresist layer, and then conducting chemical etching, electrolytic etching, electroforming mainly based on electroplating, etc., using the patterned photoresist layer as a mask.

5 [0003] At present, the photoresist composition used in the aforesaid photoelectric processing is known to include a chemically-amplified photoresist composition containing an acid generator, for example, the photoresist composition disclosed in Japanese Laid-Open Patent Application No. H09-176112 and the photoresist composition disclosed in Japanese Laid-Open Patent Application No.
10 H11-52562. In a chemically-amplified photoresist composition, acid is generated by an acid generator upon exposure to radiation, and diffusion of the acid is promoted by heat treatment, causing an acid catalytic reaction with the matrix resin in the chemically-amplified photoresist composition, resulting in a change to the alkaline solubility thereof.

15 [0004] The aforesaid chemically-amplified photoresist composition is suitable for forming electroplated molded articles such as bumps, metal columns or redistribution wiring, etc. To be specific, the chemically-amplified photoresist composition is used to form a photoresist layer on a support, such as a metal

substrate, and then the photoresist layer separated by a mask with a predetermined pattern is subjected to exposure, followed by removing the photoresist portion by development, so as to form a patterned photoresist layer serving as a casting mold. Afterwards, a conductor, such as copper, etc., is embedded in the non-photoresist portion of the patterned photoresist layer by electroplating, and then the patterned photoresist layer surrounding the conductor was removed, so as to obtain bumps, metal columns, or redistribution wiring.

[0005] However, the photosensitive resin layer formed from the aforesaid chemically-amplified photoresist composition has a problem of poor defoaming property, and the patterned photoresist layer formed from the chemically-amplified photoresist composition also has disadvantages of poor rectangularity and poor electroplating resistance, and thus are not accepted by the industry. Therefore, those skilled in the art are eager to provide a chemically-amplified photoresist composition that is capable of forming a photosensitive resin layer with good defoaming property, and a patterned photoresist layer with good rectangularity and good electroplating resistance.

SUMMARY

[0006] Therefore, an object of the present disclosure is to provide a

chemically-amplified positive-type photosensitive resin composition, a method for manufacturing a composite substrate with a casting mold, and a method for manufacturing an electroplated molded article that can alleviate at least one of the drawbacks of the prior art.

5 [0007] According to an aspect of the present disclosure, the chemically-amplified positive-type photosensitive resin composition includes an acid-dissociable resin (A), an alkali-soluble resin (B), a photoacid generator (C), and a solvent component (D). The solvent component (D) includes a solvent (D1) that has a boiling point ranging from 150°C to 190°C. A dry film formed from the
10 chemically-amplified positive-type photosensitive resin composition is subjected to Fourier transform infrared spectroscopy (FTIR) measurement. A ratio of a signal intensity of a hydroxy (–OH) group (I_{OH}) to a signal intensity of a carbonyl (C=O) group (I_{CO}) of the dry film ranges from 0.12 to 0.9.

 [0008] According to another aspect of the present disclosure, the method
15 for manufacturing a composite substrate with a casting mold includes a laminating step, an exposure step, and a development step. In the laminating step, a photosensitive resin layer composed of the aforesaid chemically-amplified positive-type photosensitive resin composition is laminated on a metal surface of a

substrate. In the exposure step, the photosensitive resin layer is irradiated with actinic rays or radiation, so as to obtain an exposed photosensitive resin layer. In the development step, the exposed photosensitive resin layer is subjected to development, so as to obtain the casting mold for forming an electroplated molded article.

[0009] According to yet another aspect of the present disclosure, the method for manufacturing an electroplated molded article includes an electroplating step and a stripping step. In the electroplating step, a composite substrate with a casting mold manufactured by the aforesaid method for manufacturing a composite substrate with a casting mold is subjected to electroplating, so as to form the electroplated molded article in the casting mold of the composite substrate. In the stripping step, the casting mold is removed with a stripping solution after forming the electroplated molded article.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010] Other features and advantages of the present disclosure will become apparent in the following detailed description of the embodiment(s) with reference to the accompanying drawings. It is noted that various features may not be drawn to scale.

[0011] FIG. 1 is a schematic view illustrating measurement of rectangularity of a patterned photoresist in property evaluation of a chemically-amplified positive-type photosensitive resin composition according to the present disclosure.

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DETAILED DESCRIPTION

[0012] Before the present disclosure is described in greater detail, it should be noted that if any prior art publication is referred to herein, such reference does not constitute an admission that the publication forms a part of the common general knowledge in the art.

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[0013] For the purpose of this specification, it will be clearly understood that the word “comprising” means “including but not limited to”, and that the word “comprises” has a corresponding meaning.

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[0014] Unless otherwise defined, all technical and scientific terms used herein have the meaning commonly understood by a person skilled in the art to which the present disclosure belongs. One skilled in the art will recognize many methods and materials similar or equivalent to those described herein, which could be used in the practice of the present disclosure. Indeed, the present disclosure is in no way limited to the methods and materials described.

[0015] The present disclosure provides a chemically-amplified positive-type photosensitive resin composition, which includes an acid-dissociable resin (A), an alkali-soluble resin (B), a photoacid generator (C), and a solvent component (D). The solvent component (D) includes a solvent (D1) that has a boiling point ranging from 150°C to 190°C. A dry film formed from the chemically-amplified positive-type photosensitive resin composition is subjected to Fourier transform infrared spectroscopy (FTIR) measurement. A ratio of a signal intensity of a hydroxy (–OH) group (I_{OH}) to a signal intensity of a carbonyl (C=O) group (I_{CO}) of the dry film ranges from 0.12 to 0.9.

[0016] When the ratio of the signal intensity of the hydroxy (–OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}), as determined by FTIR measurement, of the dry film formed from the chemically-amplified positive-type photosensitive resin composition falls outside the range of 0.12 to 0.9, a patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition has poor electroplating resistance.

[0017] In certain embodiments, when the ratio of the signal intensity of the hydroxy (–OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}), as determined by FTIR measurement, of the dry film formed from the chemically-

amplified positive-type photosensitive resin composition ranges from 0.16 to 0.85, the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition has better electroplating resistance.

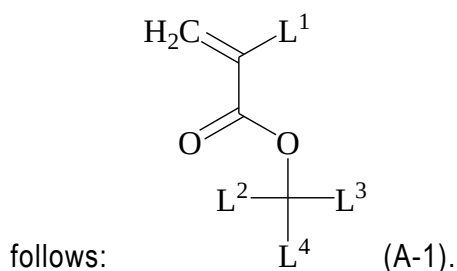
[0018] In certain embodiments, when the ratio of the signal intensity of the hydroxy (-OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}), as determined by FTIR measurement, of the dry film formed from the chemically-amplified positive-type photosensitive resin composition ranges from 0.2 to 0.8, the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition has even better electroplating resistance.

[0019] <<Acid-dissociable resin (A)>>|

[0020] The acid-dissociable resin (A) is obtained by subjecting a monomer mixture to a copolymerization reaction, and contains an acid-dissociable protecting group. To be specific, the monomer mixture includes a monomer (a1) having a structure represented by Formula (A-1), monomer (a2) containing a polyoxyalkylene chain, and other monomer (a3).

[0021] <Monomer (a1) having structure represented by Formula (A-1)>

[0022] The monomer (a) has a structure represented by Formula (A-1) as



[0023] In Formula (A-1), L¹ is a hydrogen atom, a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms, a fluorine atom, or a linear fluorinated alkyl group or a branched fluorinated alkyl group having 1 to 6 carbon atoms; and each of L², L³ and L⁴ is independently a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms, or a linear fluorinated alkyl group or a branched fluorinated alkyl group having 1 to 6 carbon atoms, or alternatively, L³ and L⁴ are bonded to each other to form a hydrocarbon ring having 5 to 20 carbon atoms.

[0024] In certain embodiments, the linear alkyl group or the branched alkyl group may include methyl, ethyl, propyl, isopropyl, n-butyl, isobutyl, tert-butyl, pentyl, isopentyl, neopentyl, etc. In addition, a fluorinated alkyl group refers to an alkyl group in which some or all of the hydrogen atoms are substituted with fluorine atoms.

[0025] In certain embodiments, when the L³ and L⁴ are not bonded to each

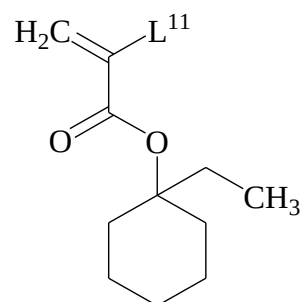
other to form the hydrocarbon ring, each of the L², L³ and L⁴ is the linear alkyl group or the branched alkyl group having 2 to 4 carbon atoms.

[0026] In certain embodiments, the L³ and L⁴, together with the carbon atoms to which they are bonded, may form a cycloaliphatic group having 5 to 20 carbon atoms. Specifically, the cycloaliphatic group may be exemplified by a group obtained by removing not less than one hydrogen atom from a monocycloalkane or from a polycycloalkane such as a bicycloalkane, a tricycloalkane, a tetracycloalkane, etc. To be specific, examples of the cycloaliphatic group may include a group obtained by removing not less than one hydrogen atom from a monocycloalkane such as cyclopentane, cyclohexane, cycloheptane, cyclooctane, etc., or from a polycycloalkane such as adamantane, norbornane, isobornylene, tricyclodecane, tetracyclododecane, etc. In certain embodiments, the cycloaliphatic group is a group obtained by removing not less than one hydrogen atom from cyclohexane or adamantane (which may further have a substituent).

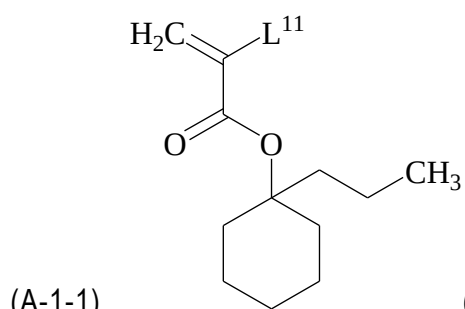
[0027] In certain embodiments, when the cycloaliphatic group formed by the L³ and L⁴ has a substituent on a ring skeleton thereof, examples of the substituent may include a polar group such as a hydroxyl group, a carbonyl group, a cyano group, an oxygen atom (=O), or a linear alkyl group or a branched alkyl

group having 1 to 4 carbon atoms. In certain embodiments, the polar group is an oxygen atom (=O).

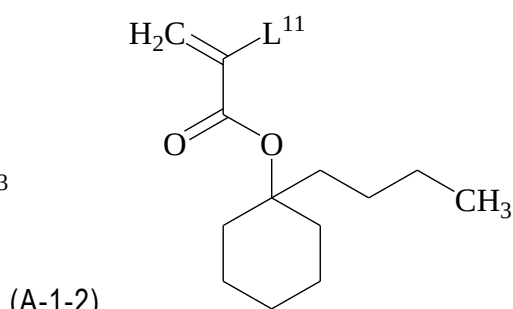
[0028] In certain embodiments, specific examples of the monomer (a1) having the structure represented by Formula (A-1) may include compounds



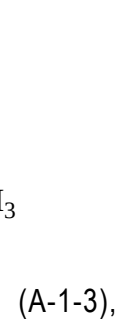
5 represented by Formulas (A-1-1) to (A-1-33) as follows:



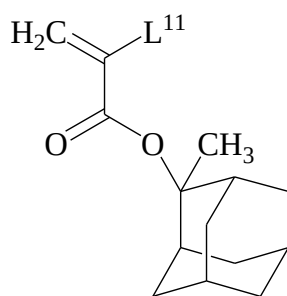
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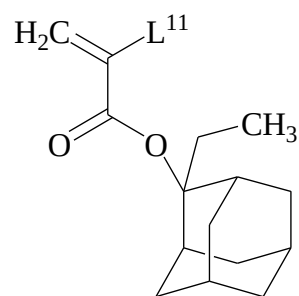
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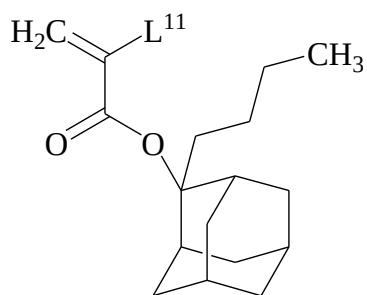
(A-1-3),



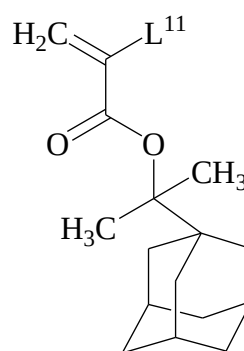
(A-1-4),



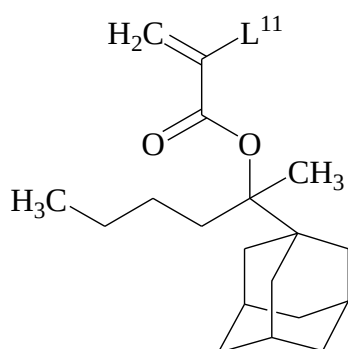
(A-1-5),



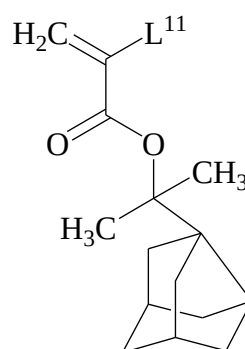
(A-1-6),



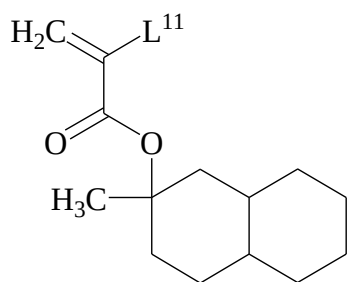
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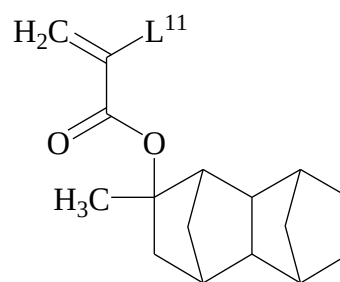
(A-1-8),



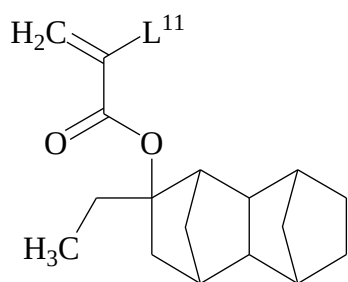
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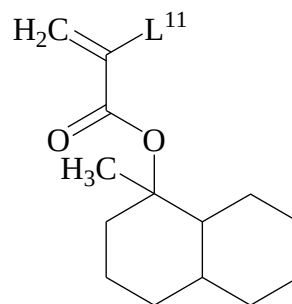
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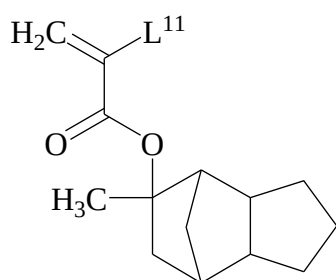
(A-1-11),



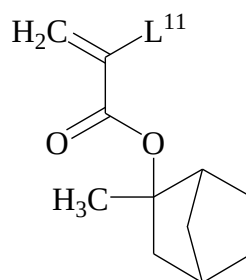
(A-1-12),



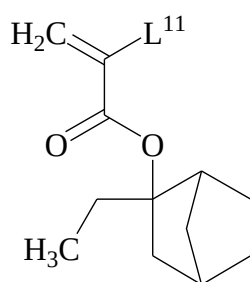
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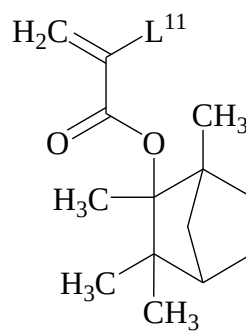
(A-1-14),



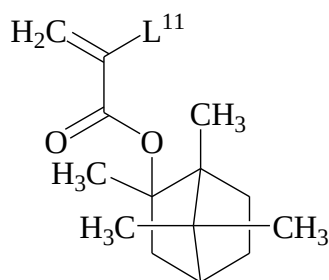
(A-1-15),



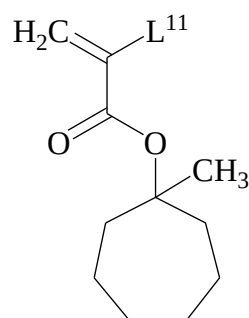
(A-1-16),



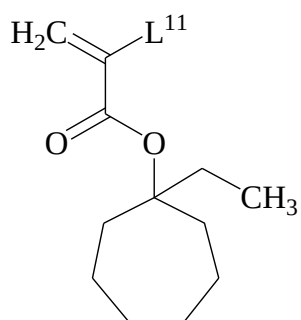
(A-1-17),



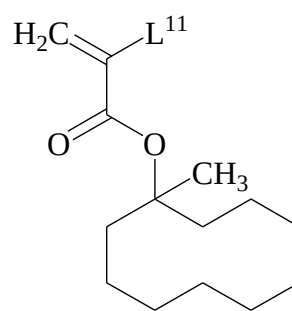
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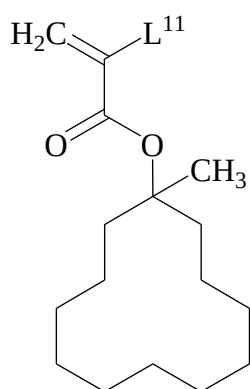
(A-1-19),



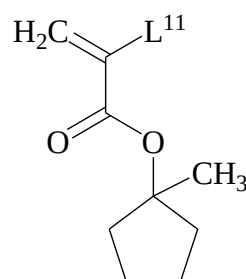
(A-1-20),



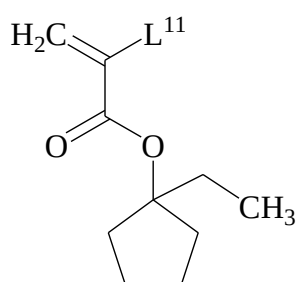
(A-1-21),



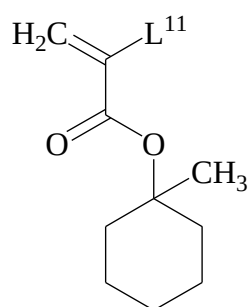
(A-1-22),



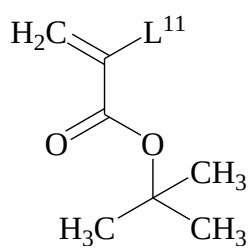
(A-1-23),



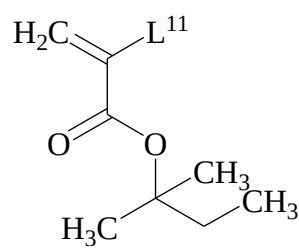
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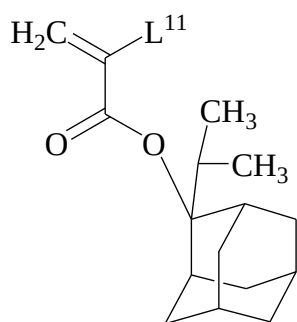
(A-1-25),



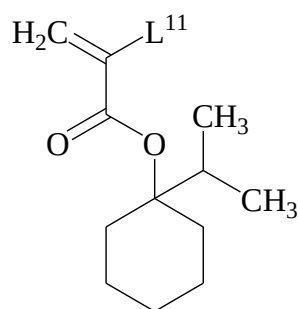
(A-1-26),



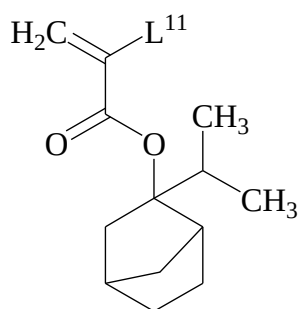
(A-1-27),



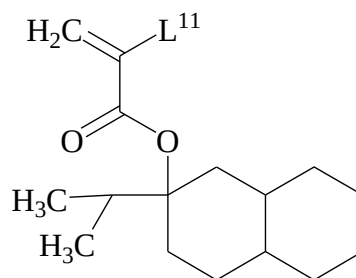
(A-1-28),



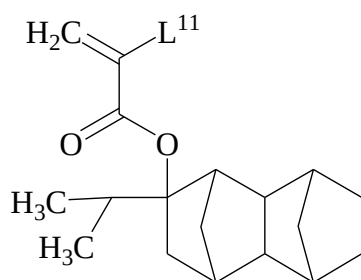
(A-1-29),



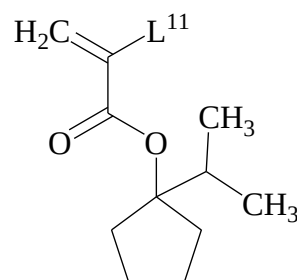
(A-1-30),



(A-1-31),



(A-1-32), and



(A-1-33).

[0029] In Formulas (A-1-1) to (A-1-33), L^{11} represents a hydrogen atom or a methyl group.

5 [0030] In certain embodiments, the monomer (a1) having the structure represented by Formula (A-1) is present in an amount ranging from 10 parts by weight to 70 parts by weight based on a total amount of the monomer mixture as 100 parts by weight. In certain embodiments, the monomer (a1) having the structure represented by Formula (A-1) is present in an amount ranging from 15

10 parts by weight to 65 parts by weight based on the total amount of the monomer mixture as 100 parts by weight. In certain embodiments, the monomer (a1) having the structure represented by Formula (A-1) is present in an amount ranging from

20 parts by weight to 60 parts by weight based on the total amount of the monomer mixture as 100 parts by weight.

[0031] If the monomer mixture does not include the monomer (a1) having the structure represented by Formula (A-1), the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition has poor rectangularity.

[0032] <Monomer (a2) containing polyoxyalkylene chain>

[0033] Specific examples of the monomer (a2) containing polyoxyalkylene chain may include, but are not limited to: ethylene oxide- (abbreviated as EO hereinafter) modified cresyl acrylate (Trade name: ARONIX TO-901), EO-modified lauryl acrylate (Trade name: ARONIX TO-950), EO-modified tridecyl acrylate (Trade name: ARONIX TO-951), and 2-ethylhexyl polyethylene glycol acrylate (Trade name: ARONIX TO-946 to TO-949) manufactured by Toagosei Co., Ltd.; ethyl diethylene glycol acrylate (Trade name: Light Acrylate EC-A), methoxy triethylene glycol acrylate (Trade name: Light Acrylate MTG-A), methoxy polyethylene glycol acrylate (Trade name: Light Acrylate 130A), phenoxy polyethylene glycol acrylate (Trade name: Light Acrylate P-200A), and nonylphenoxy polyoxyethyl chain adduct acrylate (Trade name: Light Acrylate NP-

4EA, NP-8EA) manufactured by Kyoeisha Chemical Co., Ltd.; polyethylene glycol acrylate (Trade name: BLEMMER AE-350), polyethylene glycol methacrylate (Trade name: BLEMMER PE-90, PE-200, PE-350), methoxy polyethylene glycol acrylate (Trade name: BLEMMER AME-400), methoxy polyethylene glycol methacrylate (Trade name: BLEMMER PME-100, PME-200, PME-400), polypropylene glycol methacrylate (Trade name: BLEMMER PP-500, PP-800), polyethylene glycol-polypropylene glycol methacrylate (Trade name: BLEMMER 70PEP-370B), polyethylene glycol-polybutylene glycol methacrylate (Trade name: BLEMMER 50PET-800), and octoxy-polyethylene glycol-polypropylene glycol methacrylate (Trade name: BLEMMER 50POEP-800B, 50AOEP-800B) manufactured by Nippon Oil & Fats Co., Ltd.; and methoxy-diethylene glycol methacrylate (Trade name: NK Ester M-20G, M-40G, M-90G) and phenoxy-diethylene glycol acrylate (Trade name: NK Ester AMP-20G) manufactured by Shin-Nakamura Chemical Co., Ltd.

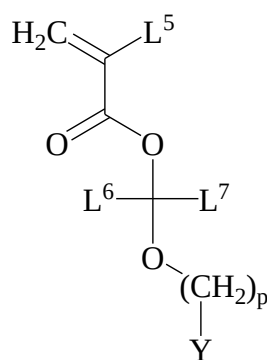
[0034] In certain embodiments, the monomer (a2) containing polyoxyalkylene chain is present in an amount ranging from 10 parts by weight to 60 parts by weight based on a total amount of the monomer mixture as 100 parts by weight. In certain embodiments, the monomer (a2) containing polyoxyalkylene

chain is present in an amount ranging from 15 parts by weight to 55 parts by weight based on a total amount of the monomer mixture as 100 parts by weight. In certain embodiments, the monomer (a2) containing polyoxyalkylene chain is present in an amount ranging from 20 parts by weight to 50 parts by weight based on a total amount of the monomer mixture as 100 parts by weight.

[0035] <Other monomer (a3)>

[0036] In certain embodiments, the monomer mixture may include other monomer (a3) which are not monomer (a1) having the structure represented by Formula (A-1) and the monomer (a2) containing polyoxyalkylene chain, as long as the effect to be achieved by the present disclosure is not affected. The other monomer (a3) is, for example, but not limited to, a compound having a structure represented by Formula (A-2), Formula (A-3), or a polymerizable compound.

[0037] The compound has a structure represented by Formula (A-2) or



Formula (A-3) as follows:

(A-2),

[0039] According to the present disclosure, the definitions for the linear alkyl group or the branched alkyl group and the linear fluorinated alkyl group or the branched fluorinated alkyl group of each of L⁵ to L¹⁰ in Formula (A-2) or Formula (A-3) are the same as the definitions for the linear alkyl group or the branched alkyl group and the linear fluorinated alkyl group or the branched fluorinated alkyl group of L¹ in Formula (A-1), and thus is not repeated herein.

[0040] In certain embodiments, when Y is a cycloaliphatic group or an alkyl

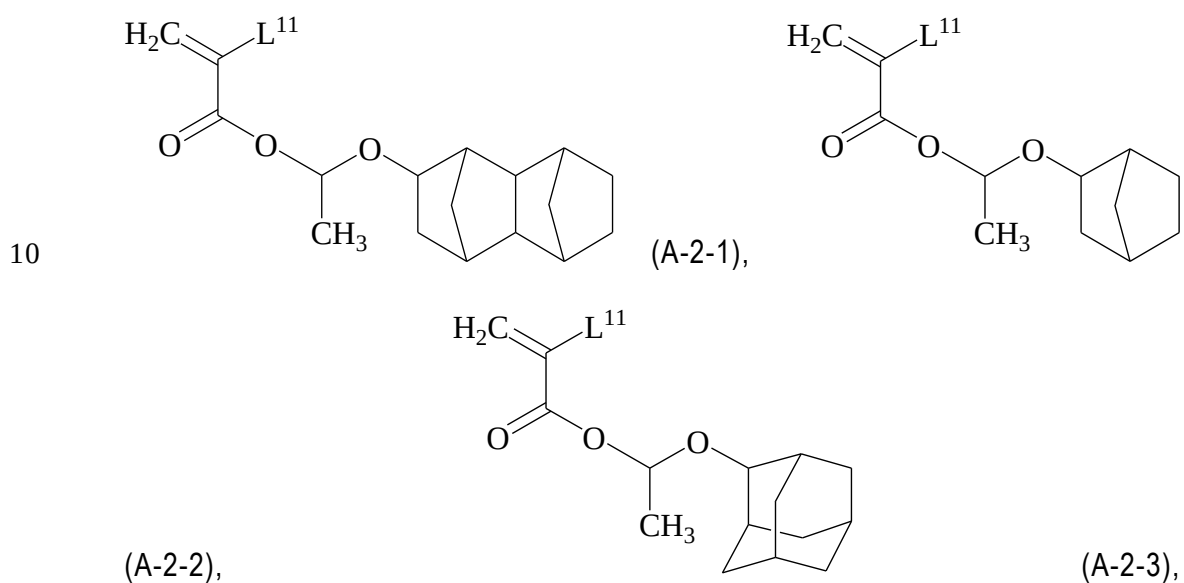
group, examples thereof may include a group obtained by removing not less than one hydrogen atom from a monocycloalkane, or from a polycycloalkane such as bicycloalkane, tricycloalkane, tetracycloalkane, etc. To be specific, when Y is a cycloaliphatic group or an alkyl group, examples thereof may include a group
5 obtained by removing not less than one hydrogen atom from a monocycloalkane such as cyclopentane, cyclohexane, cycloheptane, cyclooctane, etc., or from a polycycloalkane such as adamantane, norbornane, isobornylene, tricyclodecane, tetracyclododecane, etc. In certain embodiments, Y is a group obtained by removing not less than one hydrogen atom from adamantane, and the group thus
10 obtained by removing not less than one hydrogen atom from adamantane may further have a substituent.

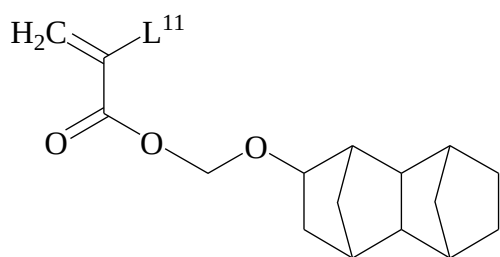
[0041] In certain embodiments, when Y is a cycloaliphatic group and has a substituent on a ring skeleton thereof, examples of the substituent may include a polar group such as a hydroxyl group, a carboxyl group, a cyano group, an oxygen
15 atom (=O), or a linear alkyl group or a branched alkyl group having 1 to 4 carbon atoms. In certain embodiments, the polar group is the oxygen atom (=O).

[0042] In certain embodiments, when Y is an alkyl group, Y is a linear alkyl group or branched alkyl group having 1 to 20 carbon atoms. In certain embodiments,

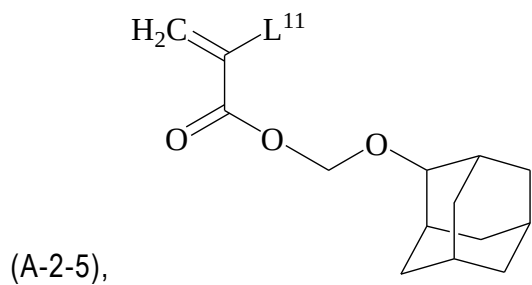
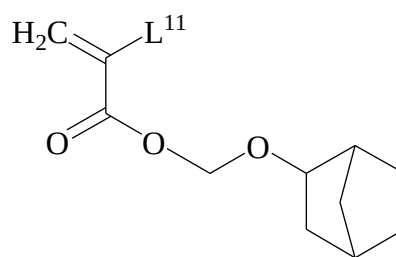
Y is a linear alkyl group or a branched alkyl group having 6 to 15 carbon atoms. In certain embodiments, the alkyl group is an alkoxyalkyl group, and examples of the alkoxyalkyl group may include, but not limited to, 1-methoxyethyl, 1-ethoxyethyl, 1-n-propoxyethyl, 1-isopropoxyethyl, 1-n-butoxyethyl, 1-isobutoxyethyl, 1-tert-butoxyethyl, 1-methoxypropyl, 1-ethoxypropyl, 1-methoxy-1-methyl-ethyl, and 1-ethoxy-1-methyl-ethyl.

[0043] In certain embodiments, specific examples of the compound having a structure represented by Formula (A-2) or Formula (A-3) may include compounds represented by Formulas (A-2-1) to (A-2-24) and (A-3-1) to (A-3-15) as follows:

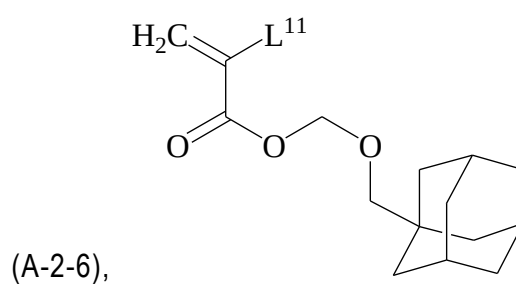




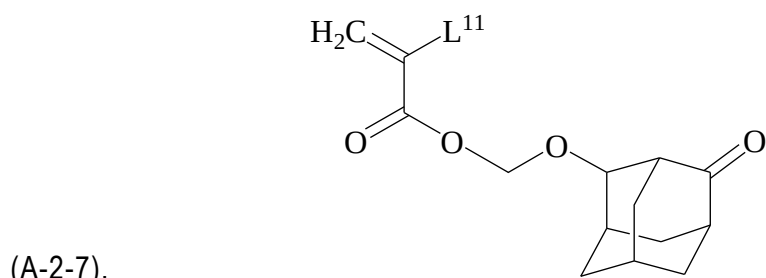
(A-2-4),



(A-2-5),

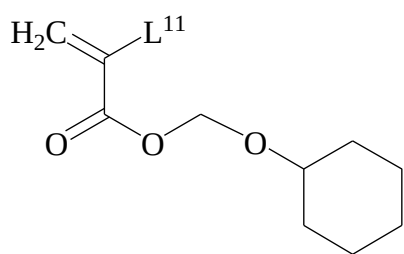


(A-2-6),

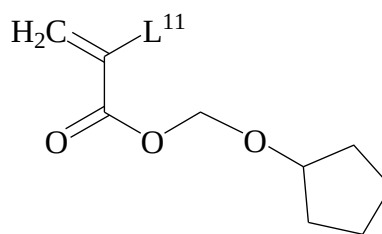


(A-2-7),

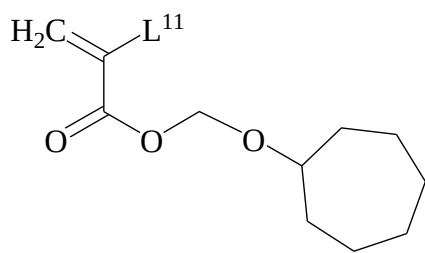
(A-2-8),



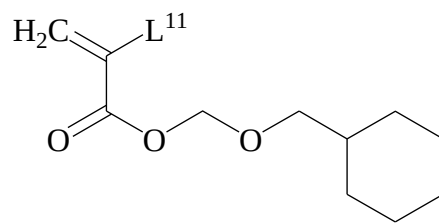
(A-2-9),



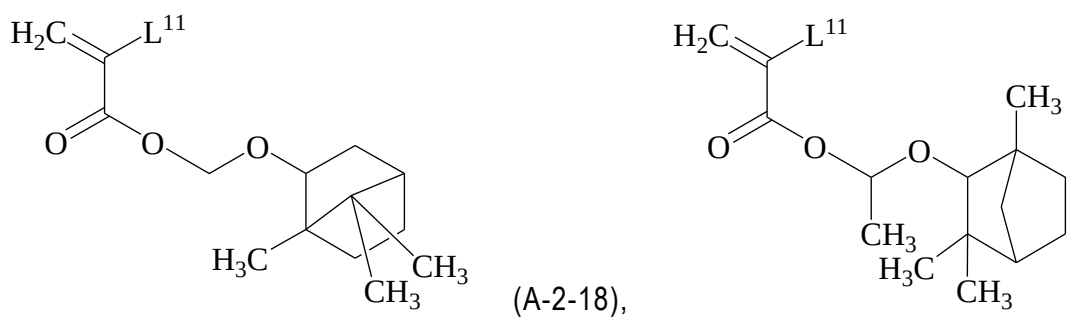
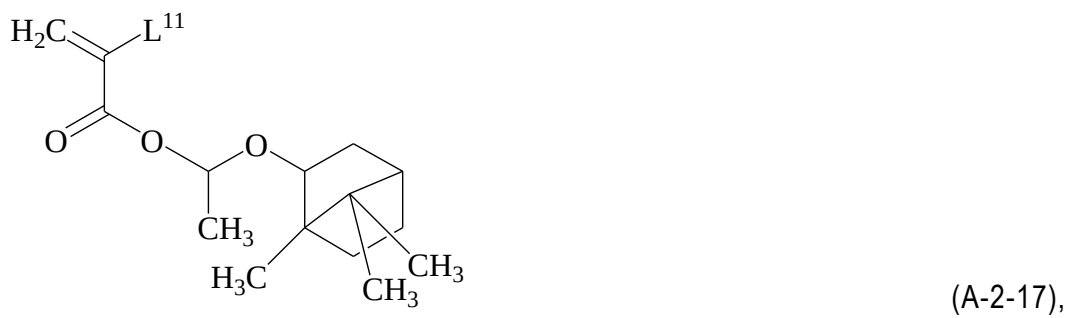
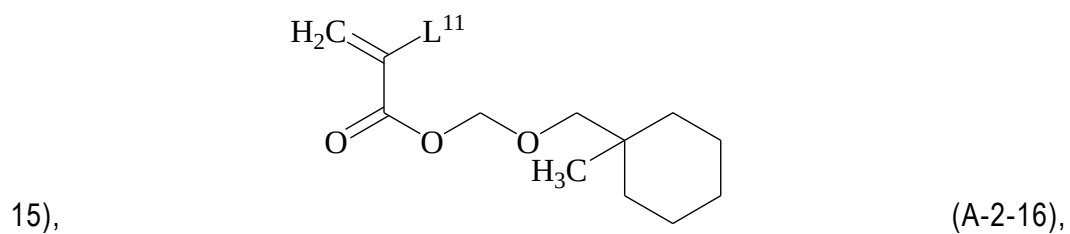
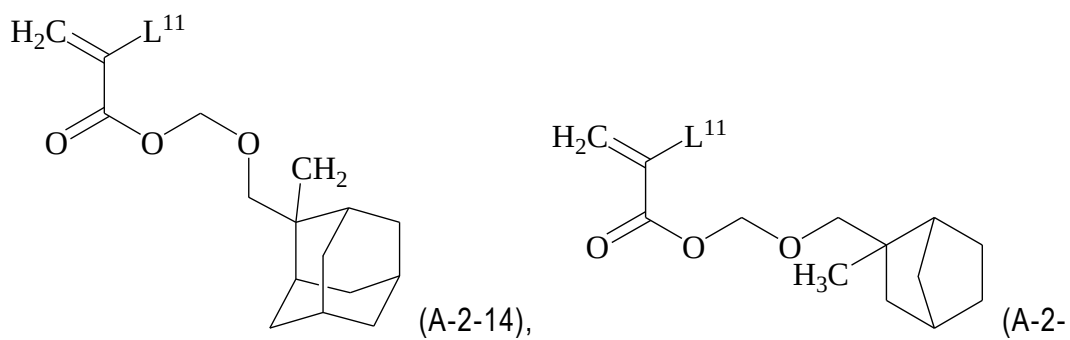
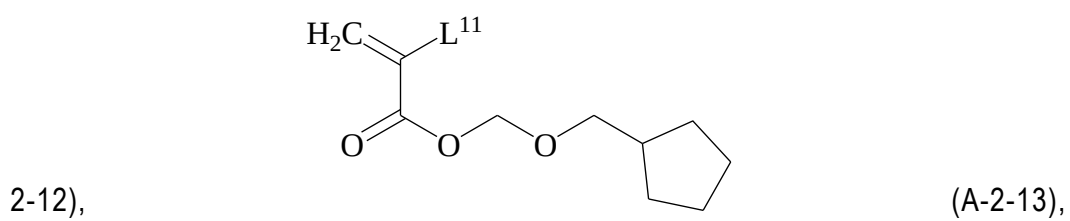
(A-2-10),

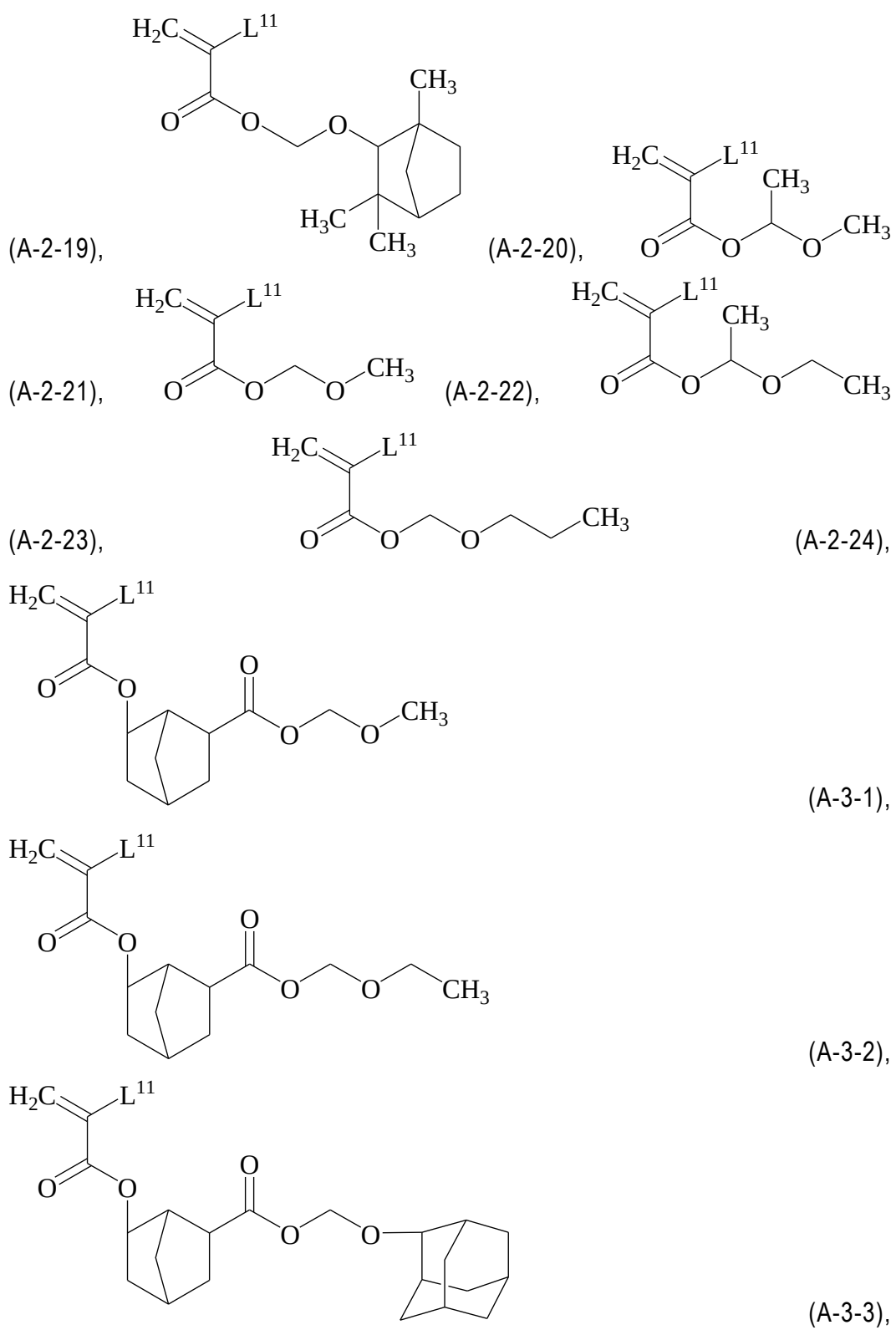


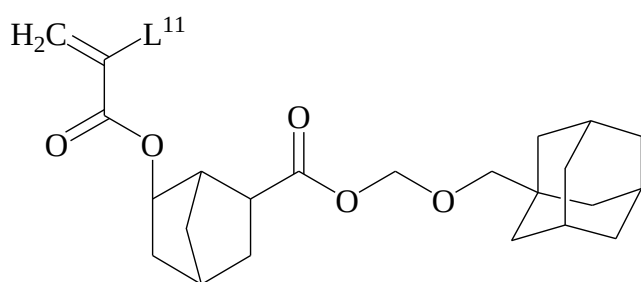
(A-2-11),



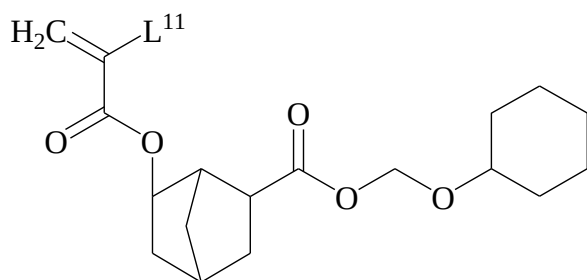
(A-2-12),



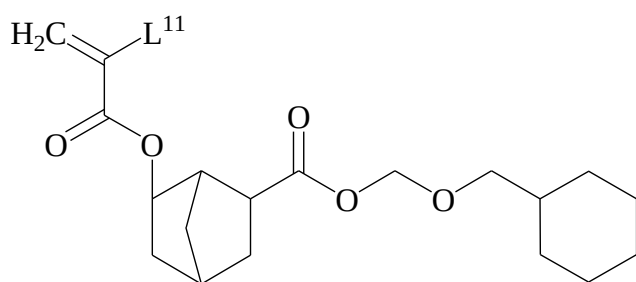




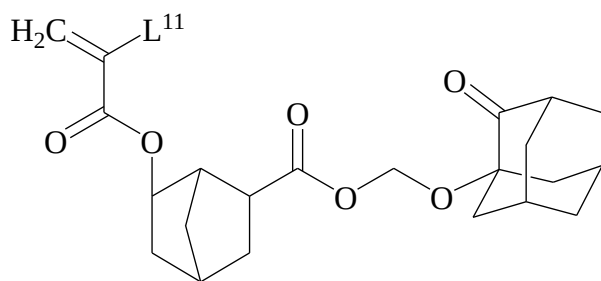
(A-3-4),



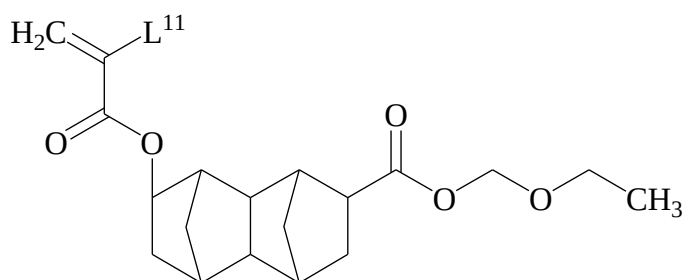
(A-3-5),



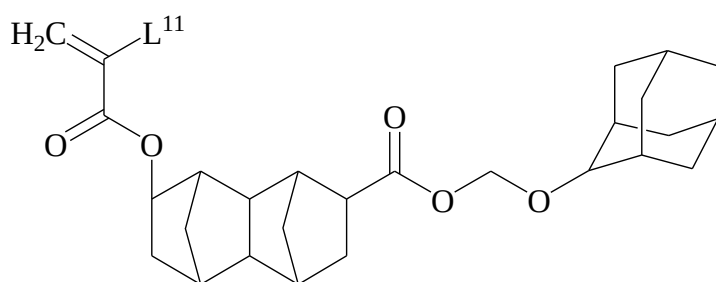
(A-3-6),



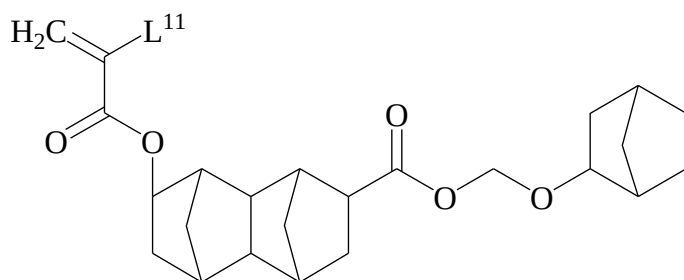
(A-3-7),



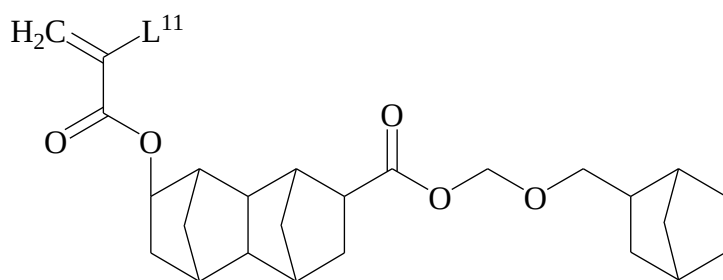
(A-3-8),



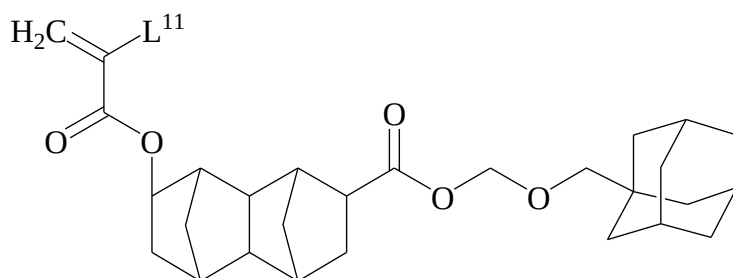
(A-3-9),



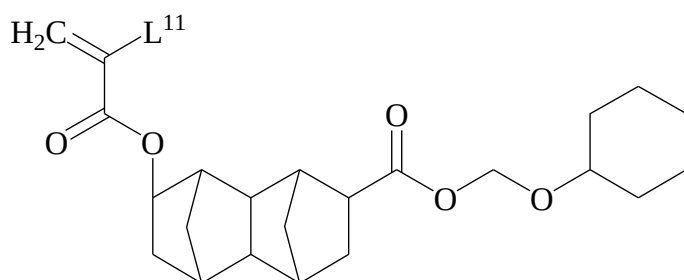
(A-3-10),



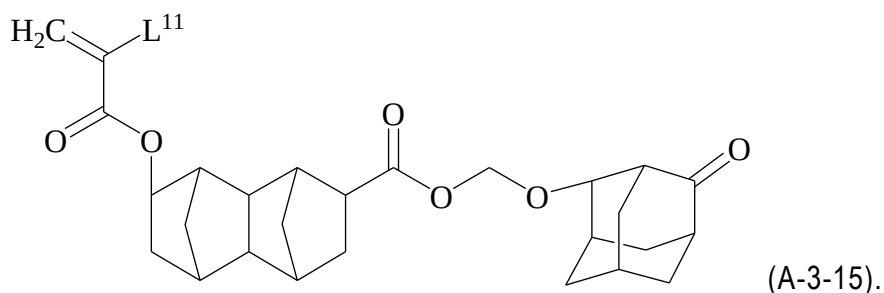
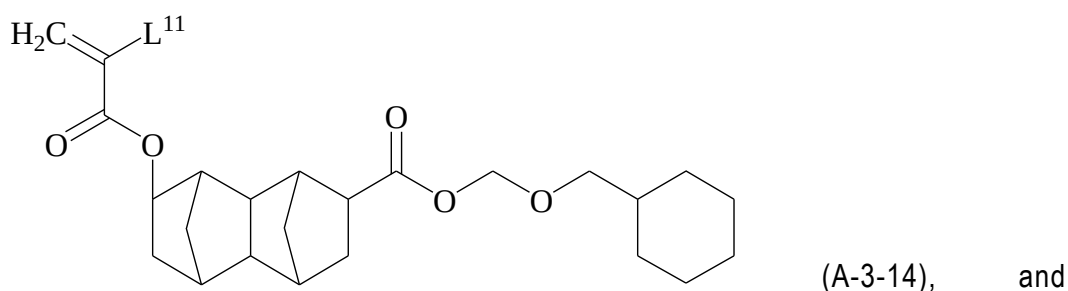
(A-3-11),



(A-3-12),



(A-3-13),



[0044] In Formulas (A-2-1) to (A-2-24) and Formulas (A-3-1) to (A-3-15),

L¹¹ represents a hydrogen atom or a methyl group.

5 [0045] In certain embodiments, the polymerizable compound is a free-radical polymerizable compound or an anionic polymerizable compound. Specific examples of the polymerizable compound may include, but are not limited to the following: monocarboxylic acid such as acrylic acid, methacrylic acid, crotonic acid, etc.; dicarboxylic acid such as maleic acid, fumaric acid, itaconic acid, etc.;

10 carboxyl group and ester bond-containing methacrylic acid derivative such as 2-methacryloyloxyethyl succinic acid, 2-methacryloyloxyethyl maleic acid, 2-methacryloyloxyethyl phthalic acid, 2-methacryloyloxyethyl hexahydrophthalic acid, etc.; alkyl (meth)acrylate such as methyl (meth)acrylate, ethyl (meth)acrylate, butyl

(meth)acrylate, cyclohexyl (meth)acrylate, etc.; hydroxyalkyl (meth)acrylate such as 2-hydroxyethyl (meth)acrylate, 2-hydroxypropyl (meth)acrylate, etc.; epoxy (meth)acrylate such as glycidyl (meth)acrylate, 2-methylglycidyl (meth)acrylate, 3,4-epoxybutyl (meth)acrylate, 6,7-epoxyheptyl (meth)acrylate, 3,4-epoxycyclohexyl (meth)acrylate or 3,4-epoxycyclohexylmethyl (meth)acrylate, etc.; aryl (meth)acrylate such as phenyl (meth)acrylate, benzyl (meth)acrylate, etc.; dicarboxylic acid diester such as diethyl maleate, dibutyl fumarate, etc.; vinyl group-containing aromatic compound such as styrene, α -methylstyrene, chlorostyrene, chloromethylstyrene, vinyltoluene, hydroxystyrene, α -methylhydroxystyrene, α -ethylhydroxystyrene, etc.; vinyl group-containing aliphatic compound such as vinyl acetate, etc.; conjugated diene such as butadiene, isoprene, etc.; nitrile-containing polymerizable compound such as acrylonitrile, methacrylonitrile, etc.; chlorine-containing polymerizable compound such as vinyl chloride, vinylidene chloride, etc.; and amide bond-containing polymerizable compound such as acrylamide, methacrylamide, etc.

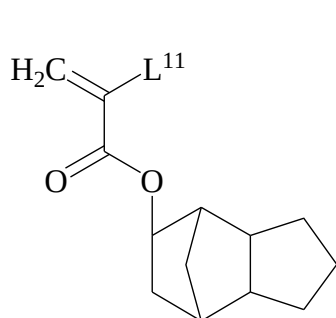
[0046] In certain embodiments, the polymerizable compound may be an acid non-dissociable polycycloaliphatic group-containing (meth)acrylate, a vinyl group-containing aromatic compound, etc. In certain embodiments, the acid non-

dissociable polycycloaliphatic group may be a tricyclodecanyl group, an adamantyl group, a tetracyclododecanyl group, an isobornyl group, a norbornyl group, etc.

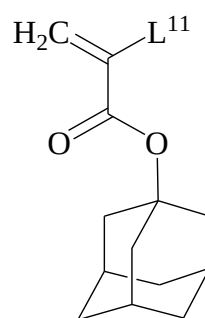
due to industrial availability thereof. In certain embodiments, the acid non-dissociable polycycloaliphatic group may have a linear alkyl group or a branched

5 alkyl group having 1 to 5 carbon atoms serving as a substituent.

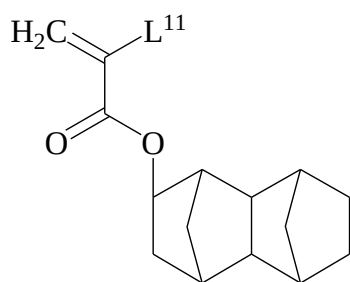
[0047] In certain embodiments, specific examples of the acid non-dissociable polycycloaliphatic group-containing (meth)acrylate may include compounds represented by Formulas (A-4-1) to (A-4-5) as follows:



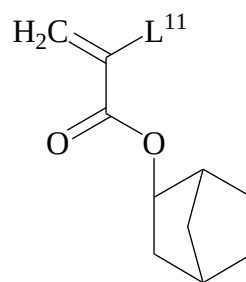
(A-4-1),



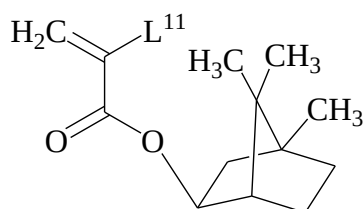
(A-4-2),



(A-4-3),



(A-4-4), and



(A-4-5).

[0048] In Formulas (A-4-1) to (A-4-5), L¹¹ represents a hydrogen atom or a methyl group.

[0049] In certain embodiments, the other monomer (a3) is present in an amount ranging from 5 parts by weight to 40 parts by weight based on a total amount of the monomer mixture as 100 parts by weight. In certain embodiments, the other monomer (a3) is present in an amount ranging from 8 parts by weight to 35 parts by weight based on the total amount of the monomer mixture as 100 parts by weight. In certain embodiments, the other monomer (a3) is present in an amount ranging from 10 parts by weight to 30 parts by weight based on the total amount of the monomer mixture as 100 parts by weight.

[0050] In certain embodiments, the acid-dissociable resin (A) has a weight average molecular weight ranging from 5000 to 50000. In certain embodiments, the acid-dissociable resin (A) has a weight average molecular weight ranging from 6000 to 45000. In certain embodiments, the acid-dissociable resin (A) has a weight average molecular weight ranging from 7000 to 40000.

[0051] In certain embodiments, the acid-dissociable resin (A) is present in an amount ranging from 25 wt% to 75 wt% based on a total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In

certain embodiments, the acid-dissociable resin (A) is present in an amount ranging from 27 wt% to 73 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the acid-dissociable resin (A) is present in an amount ranging from
5 30 wt% to 70 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

[0052] When the chemically-amplified positive-type photosensitive resin composition does not include the acid-dissociable resin (A), the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive
10 resin composition has poor rectangularity.

[0053] <<Alkali-soluble resin (B)>>

[0054] In certain embodiments, the alkali-soluble resin (B) may be a novolac resin (B1), a polyhydroxystyrene resin (B2), or a combination thereof.

[0055] <Novolac resin (B1)>

15 [0056] The novolac resin (B1) is obtained by subjecting an aldehyde compound and an aromatic hydroxyl compound to a polycondensation reaction in the presence of an acidic catalyst.

[0057] Specific examples of the aldehyde compound may include, but not

limited to, formaldehyde, paraformaldehyde, trioxane, acetaldehyde, propionaldehyde, butyraldehyde, trimethylacetaldehyde, acrolein, crotonaldehyde, cyclohexanealdehyde, furfural, furylacrolein, benzaldehyde, terephthal aldehyde, phenylacetaldehyde, α -phenylpropionaldehyde, β -phenylpropionaldehyde, o-methylbenzaldehyde, m-methylbenzaldehyde, p-methylbenzaldehyde, o-chlorobenzaldehyde, m-chlorobenzaldehyde, p-chlorobenzaldehyde, and cinnamaldehyde. One type of the aldehyde compound may be used, or a combination of multiple types of the aldehyde compound may be used. In certain embodiments, the aldehyde compound is formaldehyde or benzaldehyde.

10 [0058] Specific examples of the aromatic hydroxyl compound may include, but are not limited to, phenol; a cresol compound such as m-cresol, p-cresol and o-cresol; a xylenol compound such as 2,3-xylenol, 2,5-xylenol, 3,5-xylenol, and 3,4-xylenol; an alkyl phenol compound such as m-ethylphenol, p-ethylphenol, o-ethylphenol, 2,3,5-trimethylphenol, 2,3,5-triethylphenol, 4-tert-butylphenol, 3-tert-butylphenol, 2-tert-butylphenol, 2-tert-butyl-4-methylphenol, 2-tert-butyl-5-methylphenol, and 6-tert-butyl-3-methylphenol; an alkoxy phenol compound such as p-methoxyphenol, m-methoxyphenol, p-ethoxyphenol, m-ethoxyphenol, p-propoxyphenol, and m-propoxyphenol; an isopropenyl phenol compound such as

o-isopropenylphenol, p-isopropenylphenol, 2-methyl-4-isopropenylphenol, and 2-ethyl-4-isopropenylphenol; an aryl phenol compound such as phenyl phenol; and a polyhydroxyphenol compound such as 4,4'-dihydroxybiphenyl, bisphenol A, resorcinol, hydroquinone, and pyrogallol. One type of the aromatic hydroxyl
5 compound may be used, or a combination of multiple types of the aromatic hydroxyl compound may be used. In certain embodiments, the aromatic hydroxyl compound is 3,5-dimethylphenol, 3,4-dimethylphenol, 2,5-dimethylphenol, o-cresol, m-cresol, or p-cresol.

[0059] Specific examples of the acidic catalyst may include, but are not
10 limited to, hydrochloric acid, sulfuric acid, formic acid, acetic acid, oxalic acid, and p-toluenesulfonic acid.

[0060] One type of the novolac resin (B1) may be used, or a combination of multiple types of the novolac resin (B1) may be used.

[0061] In certain embodiments, the novolac resin (B1) has a weight
15 average molecular weight ranging from 5000 to 50000. In certain embodiments, the weight average molecular weight of the novolac resin (B1) ranges from 6000 to 45000. In certain embodiments, the weight average molecular weight of the novolac resin (B1) ranges from 7000 to 40000.

[0062] When the chemically-amplified positive-type photosensitive resin composition includes the novolac resin (B1), the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition has better electroplating resistance.

5 [0063] <Polyhydroxystyrene resin (B2)>

[0064] The polyhydroxystyrene resin (B2) is composed of a hydroxystyrene compound. Examples of the hydroxystyrene compound may include, but are not limited to, p-hydroxystyrene, α -methylhydroxystyrene, and α -ethylhydroxystyrene. In certain embodiments, the polyhydroxystyrene resin (B2) is a copolymer of the hydroxystyrene compound and a styrene resin. The styrene resin is composed of a styrene compound. Examples of the styrene compound may include, but are not limited to, styrene, chlorostyrene, chloromethylstyrene, vinyltoluene, and α -methylstyrene.

10

[0065] According to the present disclosure, a weight average molecular weight of the polyhydroxystyrene resin (B2) is not particularly limited. In certain embodiments, the weight average molecular weight of the polyhydroxystyrene resin (B2) ranges from 1000 to 50000.

15

[0066] When the chemically-amplified positive-type photosensitive resin

composition includes the polyhydroxystyrene resin (B2), the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition has better rectangularity.

[0067] <Acrylic resin (B3)>

5 [0068] In certain embodiments, the alkali-soluble resin (B) further includes an acrylic resin (B3). In certain embodiments, the acrylic resin (B3) includes a structural unit derived from a polymerizable compound having an ether bond, and another structural unit derived from a polymerizable compound having a carboxyl group.

10 [0069] Examples of the polymerizable compound having an ether bond may include, but are not limited to, a (meth)acrylic acid derivative having an ether bond and an ester bond, such as 2-methoxyethyl (meth)acrylate, methoxytriethylene glycol (meth)acrylate, 3-methoxybutyl (meth)acrylate, ethyl carbitol (meth)acrylate, phenoxypolyethylene glycol (meth)acrylate, methoxypolypropylene glycol
15 (meth)acrylate, and tetrahydrofurfuryl (meth)acrylate. In certain embodiments, the polymerizable compound having an ether bond is 2-methoxyethyl (meth)acrylate or methoxytriethylene glycol (meth)acrylate. One type of the polymerizable compound having an ether bond may be used, or a combination of multiple types of the

polymerizable compound having an ether bond may be used.

[0070] Examples of the polymerizable compound having a carboxyl group may include, but are not limited to, a monocarboxylic acid such as acrylic acid, methacrylic acid, crotonic acid, etc.; a dicarboxylic acid such as maleic acid, fumaric acid, itaconic acid, etc.; and a compound having a carboxyl group and an ester bond such as 2-methyl-2-propenoyloxyethyl succinic acid, 2-methyl-2-propenoyloxyethyl maleic acid, 2-methyl-2-propenoyloxyethyl orthophthalic acid, 2-methyl-2-propenoyloxyethyl hexahydroorthophthalic acid, etc. In certain embodiments, the polymerizable compound having a carboxyl group is acrylic acid or methacrylic acid. One type of the polymerizable compound having a carboxyl group may be used, or a combination of multiple types of the polymerizable compound having a carboxyl group may be used.

[0071] According to the present disclosure, a weight average molecular weight of the acrylic resin (B3) is not particularly limited. In certain embodiments, the weight average molecular weight of the acrylic resin (B3) ranges from 50000 to 800000.

[0072] In certain embodiments, the alkali-soluble resin (B) is present in an amount ranging from 20 wt% to 70 wt% based on the total solid content of the

chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the alkali-soluble resin (B) is present in an amount ranging from 22 wt% to 68 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the alkali-soluble resin (B) is present in an amount ranging from 25 wt% to 65 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

[0073] In certain embodiments, the novolac resin (B1) is present in an amount ranging from 20 wt% to 65 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the novolac resin (B1) is present in an amount ranging from 21 wt% to 63 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the novolac resin (B1) is present in an amount ranging from 22 wt% to 60 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

[0074] In certain embodiments, the polyhydroxystyrene resin (B2) is present in an amount ranging from 0.2 wt% to 5 wt% based on the total solid

content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the polyhydroxystyrene resin (B2) is present in an amount ranging from 0.25 wt% to 4.5 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the polyhydroxystyrene resin (B2) is present in an amount ranging from 0.3 wt% to 4 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

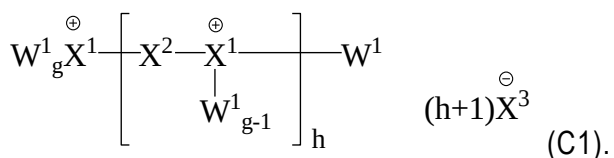
[0075] When the chemically-amplified positive-type photosensitive resin composition does not include the alkali-soluble resin (B), the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition has poor electroplating resistance.

[0076] <<Photoacid generator (C)>>

[0077] The photoacid generator (C) is a compound that generates an acid upon exposure to actinic rays or radiation, and is not particularly limited, as long as the compound can generate an acid directly or indirectly by light. In certain embodiments, the photoacid generator (C) may be exemplified by a first form of photoacid generator to a fifth form of photoacid generator as described below.

[0078] <First form of photoacid generator (C)>

[0079] An example of the first form of photoacid generator (C) may include a compound represented by Formula (C1) as follows:



[0080] In Formula (C1), X¹ is a sulfur atom having a valence of g or an iodine atom; g is 1 or 2; h is a number of repeating units of the structure in parentheses; W¹ is an organic group bonded to X¹, and the organic group is an aryl group having 6 to 30 carbon atoms, a heterocyclic group having 4 to 30 carbon atoms, an alkyl group having 1 to 30 carbon atoms, an alkenyl group having 2 to 30 carbon atoms, or an alkynyl group having 2 to 30 carbon atoms; W¹ may be substituted with at least one selected from the group consisting of an alkyl group, a hydroxyl group, an alkoxy group, an alkylcarbonyl group, an arylcarbonyl group, an alkoxy carbonyl group, an aryloxy carbonyl group, an arylthiocarbonyl group, an acyloxy group, an arylthio group, an alkylthio group, an aryl group, a heterocyclic group, an aryloxy group, an alkylsulfinyl group, an arylsulfinyl group, an alkylsulfonyl group, an arylsulfonyl group, an alkyleneoxy group, an amino group, a cyano group, a nitro group and a halogen group; a number of W¹ is g+h(g-1)+1; when a plurality of W¹s are present, they may be the same or different from each

other; not less than two W^1 may be directly bonded to each other, or bonded via -O-, -S-, -SO-, -SO₂-, -NH-, -NW²-, -CO-, -COO-, -CONH-, an alkylene group having 1 to 3 carbon atoms, or a phenylene group to form a ring structure containing X^1 ; and W^2 is an alkyl group having 1 to 5 carbon atoms, or an aryl group having 6 to 10 carbon atoms.

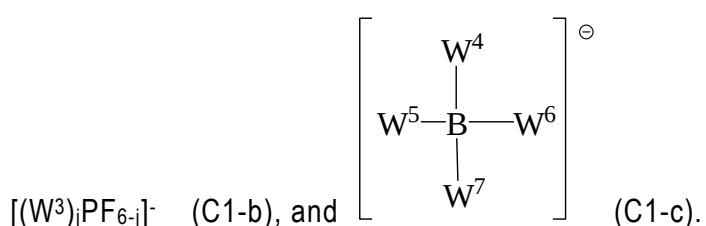
[0081] In Formula (C1), X^2 has a structure represented by Formula (C1-a)

as follows: $\text{---}X^4\text{---}\left[X^5\text{---}X^4\right]_h\text{---}$ (C1-a).

[0082] In Formula (C1-a), X^4 is an alkylene group having 1 to 8 carbon atoms, an arylene group having 6 to 20 carbon atoms, or a divalent hetero group having 8 to 20 carbon atoms; X^4 may be substituted with at least one selected from the group consisting of an alkyl group having 1 to 8 carbon atoms, an alkoxy group having 1 to 8 carbon atoms, an aryl group having 6 to 10 carbon atoms, a hydroxyl group, a cyano group, a nitro group, and a halogen group; X^5 is -O-, -S-, -SO-, -SO₂-, -NH-, -NW²-, -CO-, -COO-, -CONH-, an alkylene group having 1 to 3 carbon atoms, or a phenylene group; h is a number of repeating units of the structure in parentheses; when a plurality of X^4 s are present, they may be the same or different from each other; when a plurality of X^5 s are present, they may be the same or

different from each other; and a definition of W^2 is the same as that of W^2 in Formula (C1) above.

[0083] In Formula (C1), $(X^3)^-$ is a counter ion of onium, and examples thereof may include a fluoroalkyl fluorophosphoric acid anion represented by Formula (C1-b) or a boronic acid anion represented by Formula (C1-c) as follows:

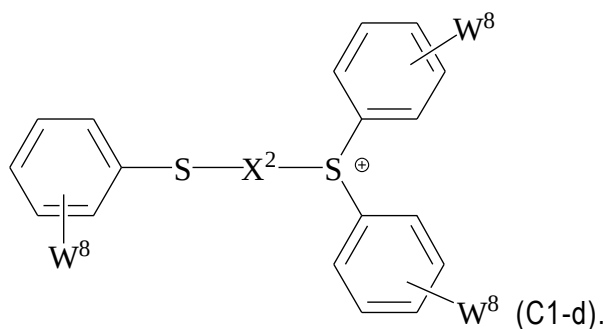


[0084] In Formula (C1-b), W^3 is an alkyl group in which not less than 80% of the hydrogen atoms are substituted with fluorine atoms; j is a number of W^3 and is an integer ranging from 1 to 5; and when a plurality of W^3 s are present, they may be the same or different from each other. In Formula (C1-c), each of W^4 and W^7 is independently a fluorine atom or a phenyl group, and a part or all of the hydrogen atoms in the phenyl group may be substituted with at least one selected from the group consisting of a fluorine atom and a trifluoromethyl group.

[0085] In certain embodiments, examples of the onium ion in the compound represented by Formula (C1) may include, but are not limited to, triphenylsulfonium, tri-p-tolylsulfonium, 4-(phenylthio)phenyl diphenyl sulfonium, bis[4-

(diphenylsulfonio)phenyl]sulfide, bis[4-{bis[4-(2-hydroxyethoxy)-phenyl]sulfonio}phenyl]sulfide, bis{4-[bis(4-fluorophenyl)sulfonio}phenyl]sulfide, 4-(4-benzoyl-2-chlorophenylthio)phenylbis(4-fluorophenyl)sulfonium, 7-isopropyl-9-oxo-10-thioxo-9,10-dihydroanthracene-2-yl-di-p-tolylsulfonium, 5 7-isopropyl-9-oxo-10-thioxo-9,10-dihydroanthracene-2-yl-diphenylsulfonium, 2-[(diphenyl)sulfonio]thioxanthone, 4-[4-(4-tert-butylbenzoyl)phenylthiol]-phenyl-di-p-tolylsulfonium, 4-(4-benzoylphenylthio)phenyl-diphenylsulfonium, biphenylphenylacetyl-sulfonium, 4-hydroxyphenylmethylbenzylsulfonium, 2-naphthylmethyl(1-ethoxycarbonyl)ethylsulfonium, 4-hydroxyphenylmethyl-10 phenylacetyl-sulfonium, phenyl[4-(4-biphenylthio)phenyl]4-biphenylsulfonium, phenyl[4-(4-biphenylthio)phenyl]3-biphenylsulfonium, [4-(4-acetylphenylthio)-phenyl]diphenylsulfonium, octadecylmethylphenylacetyl-sulfonium, diphenyliodonium, di-p-tolyl-iodonium, bis(4-methoxyphenyl)iodonium, (4-octyloxyphenyl)phenyl-iodonium, bis(4-dodecyloxyphenyl)iodonium, 4-(2-15 hydroxytetradecyloxy)phenylbiphenyl-iodonium, 4-isopropylphenyl (p-tolyl)iodonium, and 4-isobutylphenyl(p-tolyl)iodonium.

[0086] In certain embodiments, the onium ion in the compound represented by Formula (C1) is a sulfonium ion represented by Formula (C1-d) as follows:



[0087] In Formula (C1-d), each W^8 is independently a group selected from a group consisting of a hydrogen atom, an alkyl group, a hydroxyl group, an alkoxy group, an alkylcarbonyl group, an alkylcarbonyloxy group, an alkoxy carbonyl group, a halogen atom, an aryl group which may have a substituent, and an acrylcarbonyl group; and a definition of X^2 is the same as that of X^2 in Formula (C1).

[0088] In certain embodiments, specific examples of the sulfonium ion represented by Formula (C1-d) may include 4-(phenylthio)phenyldiphenylsulfonium, 4-(4-benzoyl-2-chlorophenylthio)phenyl bis(4-fluorophenyl)sulfonium, 4-(4-benzoylphenylthio)phenyldiphenylsulfonium, phenyl[4-(4-biphenylthio)phenyl]4-biphenylsulfonium, phenyl[4-(4-biphenylthio)phenyl]3-biphenylsulfonium, [4-(4-acetylphenylthio)phenyl]diphenylsulfonium, and diphenyl[4-(p-triphenylthio)phenyl]diphenylsulfonium.

[0089] According to the present disclosure, in the fluoroalkyl fluorophosphoric acid anion represented by Formula (C1-b), W^3 is a fluorinated alkyl group. In certain embodiments, in the fluoroalkyl fluorophosphoric acid anion represented by Formula (C1-b), W^3 is a fluorinated alkyl group having 1 to 8 carbon atoms. In certain embodiments, in the fluoroalkyl fluorophosphoric acid anion represented by Formula (C1-b), W^3 is a fluorinated alkyl group having 1 to 4 carbon atoms. Specific examples of the alkyl group may include, a linear alkyl group such as methyl, ethyl, propyl, butyl, pentyl, octyl, etc.; a branched alkyl group such as isopropyl, isobutyl, sec-butyl, tert-butyl, etc.; a cycloalkyl group such as cyclopropyl, cyclobutyl, cyclopentyl, cyclohexyl, etc; and the like. In certain embodiments, the proportion of hydrogen atoms in the alkyl group being substituted with fluorine atoms is usually not less than 80%. In certain embodiments, the proportion of hydrogen atoms in the alkyl group being substituted with fluorine atoms is not less than 90%. In certain embodiments, the proportion of hydrogen atoms in the alkyl group being substituted with fluorine atoms is 100%. If the proportion of hydrogen atoms in the alkyl group being substituted with fluorine atoms is less than 80%, the acid strength of an onium salt of a fluoroalkyl fluorophosphoric acid having a structure represented by Formula (C1) will

decrease.

[0090] In certain embodiments, W^3 is a linear perfluoroalkyl group or a branched perfluoroalkyl group having 1 to 4 carbon atoms, and substitution rate of fluorine atoms of 100%. Specific examples of W^3 may include CF_3 , CF_3CF_2 ,
 5 $(CF_3)_2CF$, $CF_3CF_2CF_2$, $CF_3CF_2CF_2CF_2$, $(CF_3)_2CFCF_2$, $CF_3CF_2(CF_3)CF$, and $(CF_3)_3C$.
 In certain embodiments, j is a number of W^3 , and is an integer ranging from 1 to 5.
 In certain embodiments, j is an integer ranging from 2 to 4. In certain embodiments, j is an integer ranging from 2 to 3.

[0091] In certain embodiments, specific examples of the fluoroalkyl
 10 fluorophosphoric acid anion represented by Formula (C1-b) may include
 $[(CF_3CF_2)_2PF_4]^-$, $[(CF_3CF_2)_3PF_3]^-$, $[((CF_3)_2CF)_2PF_4]^-$, $[((CF_3)_2CF)_3PF_3]^-$,
 $[(CF_3CF_2CF_2)_2PF_4]^-$, $[(CF_3CF_2CF_2)_3PF_3]^-$, $[((CF_3)_2CFCF_2)_2PF_4]^-$,
 $[((CF_3)_2CFCF_2)_3PF_3]^-$, $[(CF_3CF_2CF_2CF_2)_2PF_4]^-$ and $[(CF_3CF_2CF_2)_3PF_3]^-$. In certain
 embodiments, the fluoroalkyl fluorophosphoric acid anion may be $[(CF_3CF_2)_3PF_3]^-$,
 15 $[(CF_3CF_2CF_2)_3PF_3]^-$, $[((CF_3)_2CF)_3PF_3]^-$, $[((CF_3)_2CF)_2PF_4]^-$, $[((CF_3)_2CFCF_2)_3PF_3]^-$
 and $[(CF_3)_2CFCF_2)_2PF_4]^-$.

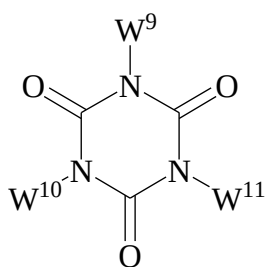
[0092] In certain embodiments, specific examples of the boronic acid anion
 represented by Formula (C1-c) may include tetrakis(pentafluorophenyl)borate

$[\text{B}(\text{C}_6\text{F}_5)_4]^-$, tetrakis[(trifluoromethyl)phenyl]borate $[\text{B}(\text{C}_6\text{H}_4\text{CF}_3)_4]^-$,
 difluorobis(pentafluorophenyl)borate $[(\text{C}_6\text{F}_5)_2\text{BF}_2]^-$, trifluoro(pentafluorophenyl)borate
 $[(\text{C}_6\text{F}_5)\text{BF}_3]^-$, tetrakis(difluorophenyl)borate $[\text{B}(\text{C}_6\text{H}_3\text{F}_2)_4]^-$, etc. In certain embodiments, the
 boronic acid anion represented by Formula (C1-c) is tetrakis(pentafluorophenyl)borate
 5 $[\text{B}(\text{C}_6\text{F}_5)_4]^-$.

[0093] < Second form of photoacid generator (C) >

[0094] Examples of the second form of photoacid generator (C) may
 include halogenated triazine compound such as 2,4-
 bis(trichloromethyl)-6-(2-piperonyl)-1,3,5-triazine, 2,4-
 10 bis(trichloromethyl)-6-[2-(2-furyl)vinyl]-1,3,5-triazine, 2,4-
 bis(trichloromethyl)-6-[2-(5-methyl-2-furyl)vinyl]-1,3,5-triazine, 2,4-
 bis(trichloromethyl)-6-[2-(5-ethyl-2-furyl)vinyl]-1,3,5-triazine, 2,4-
 bis(trichloromethyl)-6-[2-(5-propyl-2-furyl)vinyl]-1,3,5-triazine, 2,4-
 bis(trichloromethyl)-6-[2-(3,5-dimethoxyphenyl)vinyl]-1,3,5-triazine,
 15 2,4-bis(trichloromethyl)-6-[2-(3,5-diethoxyphenyl)vinyl]-1,3,5-
 triazine, 2,4-bis(trichloromethyl)-6-[2-(3,5-dipropoxyphenyl)vinyl]-
 1,3,5-triazine, 2,4-bis(trichloromethyl)-6-[2-(3-methoxy-5-
 ethoxyphenyl)vinyl]-1,3,5-triazine, 2,4-bis(trichloromethyl)-6-[2-(3-

methoxy-5-propoxyphenyl)vinyl]-1,3,5-triazine, 2,4,-
bis(trichloromethyl)-6-[2-(3,4-methylenedioxyphenyl)vinyl]-1,3,5-
triazine, 2,4,-bis(trichloromethyl)-6-(3,4-methylenedioxyphenyl)-
1,3,5-triazine, 2,4,-bis(trichloromethyl)-6-(3-bromo-4-
5 methoxyphenyl)-1,3,5-triazine, 2,4,-bis(trichloromethyl)-6-(2-bromo-
4-methoxyphenyl)-1,3,5-triazine, 2,4,-bis(trichloromethyl)-6-(2-
bromo-4-methoxystyrylphenyl)-1,3,5-triazine, 2,4,-
bis(trichloromethyl)-6-(3-bromo-4-methoxystyrylphenyl)-1,3,5-
triazine, 2-(4-methoxyphenyl)-4,6-bis(trichloromethyl)-1,3,5-triazine,
10 2-[2-(2-furanylethenyl)-4,6-bis(trichloromethyl)-1,3,5-triazine, 2-[2-
(5-methyl-2-furanylethenyl)-4,6-bis(trichloromethyl)-1,3,5-triazine,
2-[2-(3,5-dimethoxyphenylethenyl)-4,6-bis(trichloromethyl)-1,3,5-
triazine, 2-[2-(3,4-dimethoxyphenylethenyl)-4,6-bis(trichloromethyl)-
1,3,5-triazine, 2-[2-(3,4-methylenedioxyphenyl)-4,6-
15 bis(trichloromethyl)-1,3,5-triazine, 1,3,5-tris(1,3-
dibromopropyl)triazine, 1,3,5-tris(2,3-dibromopropyl)triazine, etc.,
and other halogenated triazine compounds such as 2,3,-
dibromopropyl isocyanate, etc. which are represented by Formula (C2) as



follows: (C2).

[0095] In Formula (C2), each of W9 and W11 is independently a halogenated alkyl group.

[0096] < Third form of photoacid generator (C) >

5 [0097] Examples of the third form of photoacid generator (C) may include

α -(-toluenesulfonyloxyimino)phenylacetonitrile, α -

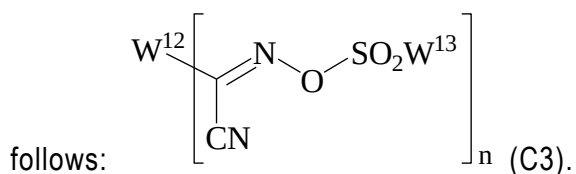
(benzenesulfonyloxyimino)-2,4-dichlorophenylacetonitrile, α -

(benzenesulfonyloxyimino)-2,6-dichlorophenylacetonitrile, α -(2-

chlorobenzenesulfonyloxyimino)-4-methoxyphenylacetonitrile, α -

10 (ethanesulfonyloxyimino)-1-chloropentenylacetonitrile, and a

compound having an oxime sulfonate group as represented by Formula (C3) as



[0098] In Formula (C3), W¹² is a monovalent, divalent or trivalent organic group; W¹³ is a saturated hydrocarbon group, an unsaturated hydrocarbon group,

or an aromatic compound group which is substituted or unsubstituted; and n is a number of repeating units of the structure in parentheses.

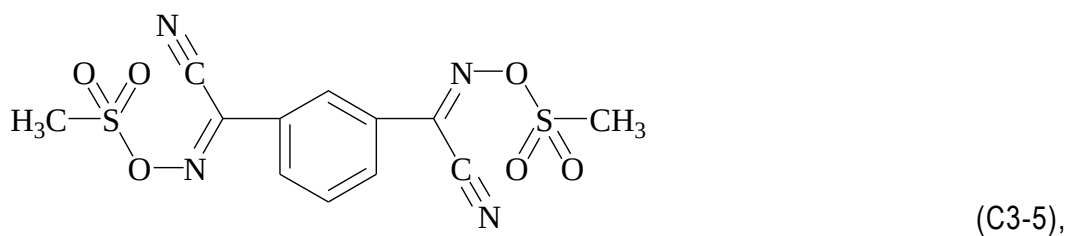
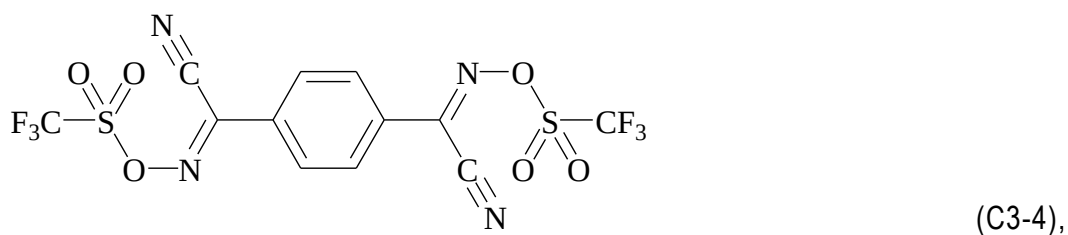
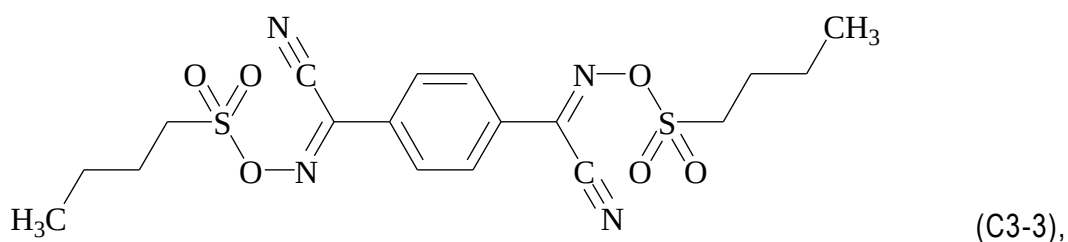
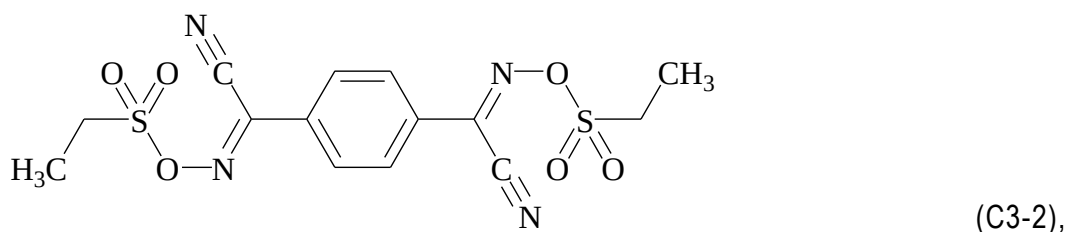
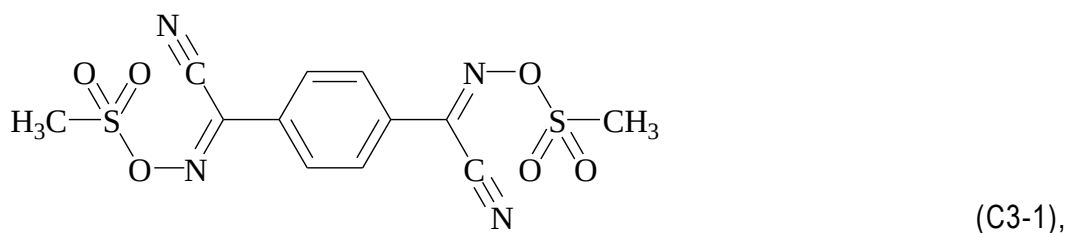
[0099] In Formula (C3), the aromatic compound group refers to a group of compound that exhibits unique physical and chemical properties. Examples of the aromatic compound group may include an aryl group such as phenyl, naphthyl, etc., or a heteroaryl group such as furyl, thienyl, etc. The aryl group and the heteroaryl group may have not less than one appropriate substituents on the ring, such as a halogen atom, an alkyl group, an alkoxy group, a nitro group, etc. In certain embodiments, W^{13} is an alkyl group having 1 to 6 carbon atoms, and examples thereof may include methyl, ethyl, propyl, and butyl. In certain embodiments, in the compound represented by Formula (C3), W^{12} is an aromatic compound group and W^{13} is an alkyl group having 1 to 4 carbon atoms.

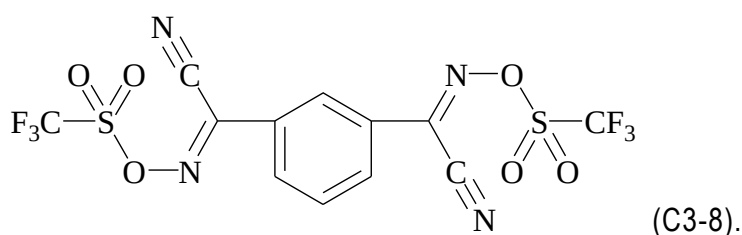
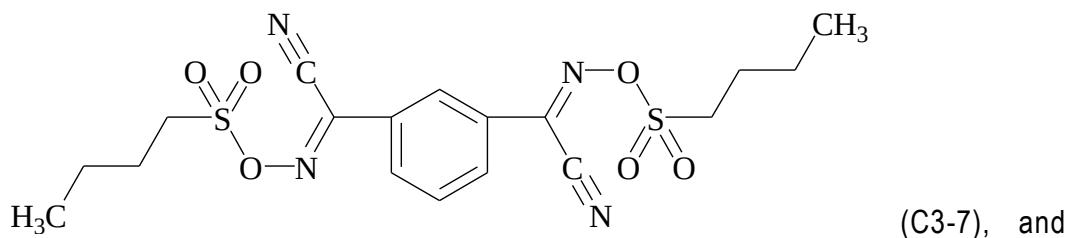
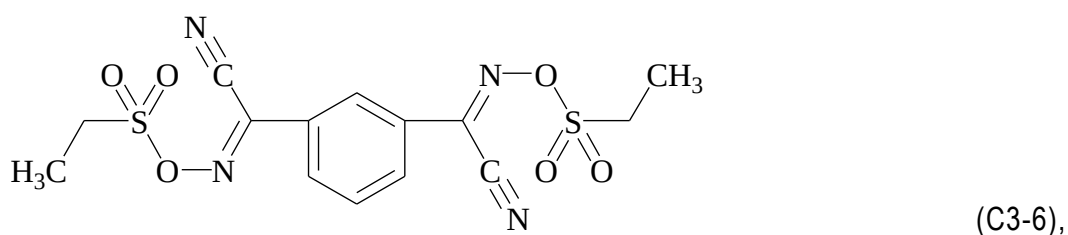
[00100] In certain embodiments, in the compound represented by Formula (C3), when $n=1$, W^{12} may be any one of phenyl, methylphenyl and methoxyphenyl; and W^{13} is a methyl-containing compound, and specific examples thereof may include α -(methanesulfonyloxyimino)-1-phenylacetonitrile, α -(methanesulfonyloxyimino)-1-(p-methylphenyl)acetonitrile, α -(methanesulfonyloxyimino)-1-(p-methoxyphenyl)acetonitrile, [2-

(propylsulfonyloxyimino)-2,3-dihydrothiophen-3-yl] (o-tolyl)-

acetonitrile, etc. In certain embodiments, when $n=2$, specific examples of the compound represented by Formula (C3) may include third form of photoacid generators represented by Formulas (C3-1) to (C3-8) as follows:

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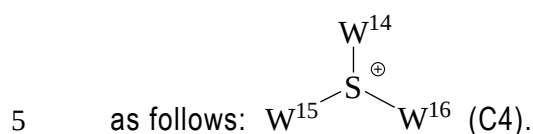
[00101] <Fourth form of photoacid generator (C)>

5 [00102] An example of the fourth form of photoacid generator (C) may include an onium salt having a naphthyl ring in a cation moiety. The term “having a naphthyl ring” refers to a structure derived from naphthalene, indicating a structure with at least two rings, and aromaticity thereof can be maintained. The naphthyl ring may also have a substituent such as a linear alkyl group or a

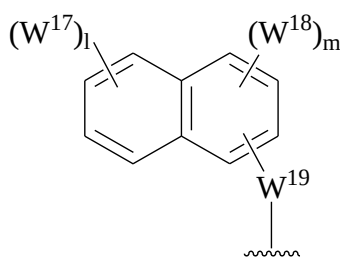
10 branched alkyl group having 1 to 6 carbon atoms, a hydroxyl group, or a linear alkoxy group or a branched alkoxy group having 1 to 6 carbon atoms, etc. The structure derived from naphthyl ring may be a monovalent group (free atomic valence of 1) or a divalent group (free atomic valence of not less than 2). In certain

embodiments, a number of rings in the structure derived from naphthyl ring ranges from 1 to 3.

[00103] In certain embodiments, the cation moiety of the onium salt having a naphthyl ring in the cation moiety has a structure represented by Formula (C4)



[00104] In Formula (C4), at least one of W^{14} to W^{16} is a group represented



by Formula (C4-a) as follows: (C4-a), and remaining

one(s) is a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms,

a phenyl group which may have a substituent, a hydroxyl group, or a linear alkoxy

10 group or a branched alkoxy group having 1 to 6 carbon atoms. Alternatively, one

of W^{14} to W^{16} is a group represented by Formula (C4-a) shown above, and the

other two are independently a linear alkylene group or a branched alkylene group

having 1 to 6 carbon atoms, and end portions of the alkylene groups may be bonded

to form a ring.

[00105] In Formula (C4-a), each of W¹⁷ and W¹⁸ is independently a hydroxyl group, a linear alkoxy group or a branched alkoxy group having 1 to 6 carbon atoms, or a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms; W¹⁸ is a single bond or a linear alkylene group or a branched alkylene group having 1 to 6 carbon atoms which may have a substituent; each of l and m independently is an integer ranging from 0 to 2, and 1+m is not greater than 3; when a plurality of W¹⁷s are present, they may be the same as or different from each other; and when a plurality of W¹⁸s are present, they may be the same as or different from each other.

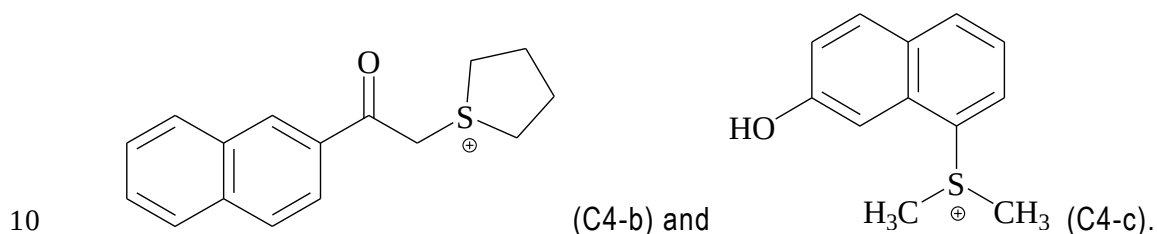
[00106] In certain embodiments, from the viewpoint of compound stability, the number of the group represented by Formula (C4-a), among W¹⁴ to W¹⁶, is preferably one, and remaining one(s) is a linear alkylene group or a branched alkylene group having 1 to 6 carbon atoms, and end portions of the alkylene groups may be bonded to form a ring. In this case, the two alkylene groups each may contain a sulfur atom so as to form a 3- to 9-membered ring. In certain embodiments, the number of atoms (including the sulfur atom) constituting the ring ranges from 5 to 6.

[00107] In certain embodiments, examples of the substituent that the

alkylene group may have, include an oxygen atom (which forms a carbonyl group with the carbon atom constituting the alkylene group), a hydroxyl atom, etc.

[00108] In certain embodiments, examples of the substituent that the phenyl group may have, include a hydroxyl group, a linear alkoxy group or a branched alkoxy group having 1 to 6 carbon atoms, a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms, etc.

[00109] In certain embodiments, suitable examples of the cation moiety of the onium salt having a naphthyl ring in the cation moiety includes structures represented by Formulas (C4-b) and (C4-c) as follows:



[00110] In certain embodiments, the cation moiety may be an iodonium salt or a sulfonium salt. In certain embodiments, from the viewpoint of acid generation efficiency, the cation moiety is a sulfonium salt.

[00111] In certain embodiments, with respect to an anion moiety of the onium salt having a naphthyl ring in the cation moiety, an anion that is capable of forming a sulfonium salt is desirable.

[00112] In certain embodiments, the anion moiety of the onium salt having a naphthyl ring in the cation moiety is a fluoroalkylsulfonate ion in which a portion or all of the hydrogen atoms are fluorinated, or an arylsulfonate ion.

[00113] According to the present disclosure, the alkyl group in the fluoroalkylsulfonate ion may be a linear alkyl group, a branched alkyl group or a cyclic alkyl group having 1 to 20 carbon atoms. In certain embodiments, based on the volume of the generated acid and diffusion distance thereof, the alkyl group in the fluoroalkylsulfonate ion is an alkyl group having 1 to 10 carbon atoms, among which a branched alkyl group or a cyclic alkyl group are preferred because of their short diffusion distance. In certain embodiments, in view of low synthesis cost, examples of the alkyl group in the fluoroalkylsulfonate ion may include methyl, ethyl, propyl, butyl, octyl, etc.

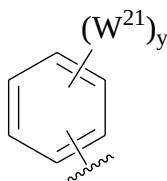
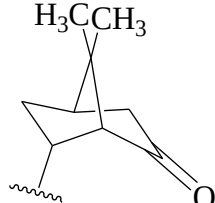
[00114] According to the present disclosure, the aryl group in the arylsulfonate ion is an aryl group having 6 to 20 carbon atoms. Examples of the aryl group may include a phenyl group and a naphthyl group which may be substituted with an alkyl group or a halogen atom. In certain embodiments, in view of low synthesis cost, the aryl group in the arylsulfonate ion is an aryl group having 6 to 10 carbon atoms. In certain embodiments, specific examples of the aryl group

may include a phenyl, tosyl, ethylphenyl, naphthyl, methylnaphthyl, etc.

[00115] In certain embodiments, in the fluoroalkylsulfonate ion or the arylsulfonate ion, when a portion or all of the hydrogen atoms are fluorinated, the fluorination rate ranges from 10% to 100%. In certain embodiments, when a portion or all of the hydrogen atoms are fluorinated, the fluorination rate ranges from 50% to 100%, among which, when all of the hydrogen atoms are substituted with fluorine atoms are particularly preferred because the acid strength is enhanced. Specific examples under this category may include trifluoromethanesulfonate, perfluorobutanesulfonate, perfluorooctanesulfonate, perfluorobenzenesulfonate, etc.

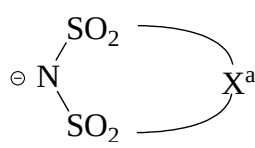
[00116] In certain embodiments, an example of the anion moiety of the onium salt having a naphthyl ring in the cation moiety may include an anion moiety having a structure represented by Formula (C4-d) as follows: $W^{20}SO_3^-$ (C4-d).

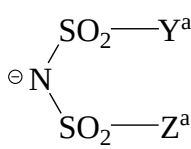
[00117] In Formula (C4-d), W^{20} is a group represented by Formulas (C4-e)

to (C4-g) as follows: $-C_xF_{2x+1}$ (C4-e),  (C4-f) and  (C4-g).

[00118] In Formula (C4-e), x is an integer ranging from 1 to 4. In Formula (C4-f), W²¹ is a hydrogen atom, a hydroxyl group, a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms, a linear alkoxy group or a branched alkoxy group having 1 to 6 carbon atoms; and y is an integer ranging from 1 to 3. In certain
 5 embodiments, from the viewpoint of safety, the anion moiety of onium salt having a naphthyl ring in the cation moiety is trifluoromethanesulfonate or perfluorobutanesulfonate.

[00119] In certain embodiments, the anion moiety of onium salt having a naphthyl ring in the cation moiety may also have a nitrogen-containing structure as

10 represented by Formulas (C4-h) and (C4-i) as follows:  (C4-)

h) and  (C4-i).

[00120] In Formula (C4-h), X^a is a linear alkylene group or a branched alkylene group in which at least one hydrogen atom is substituted with a fluorine atom, and the number of carbon atoms of the alkylene group ranges from 2 to 6.

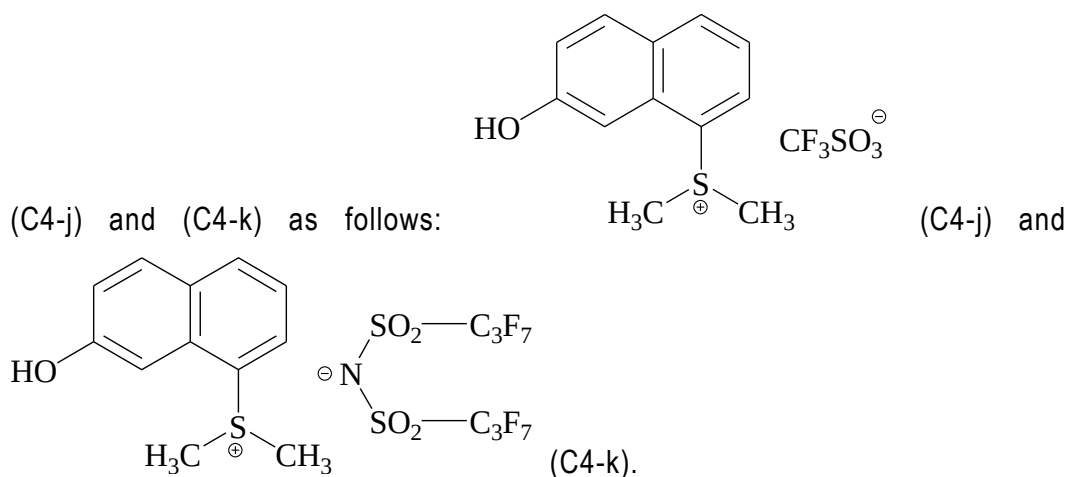
15 In certain embodiments, the number of carbon atoms in the alkylene group ranges from 3 to 5. In certain embodiments, the number of carbon atoms in the alkylene

group is 3. In Formula (C4-i), each of Y^a and Z^a is independently a linear alkyl group or a branched alkyl group in which at least one hydrogen atom is substituted with a fluorine atom, and the number of carbon atoms in the alkyl group ranges from 1 to 10. In certain embodiments, the number of carbon atoms in the alkyl group ranges from 1 to 7. In certain embodiments, the number of carbon atoms in the alkyl group ranges from 1 to 3.

[00121] According to the present disclosure, the smaller the number of carbon atoms in the alkylene group of X^a , or in the alkyl group of Y^a and Z^a is, the better the solubility in an organic solvent is, and thus is preferred.

10 [00122] In certain embodiments, the greater the number of hydrogen atoms in the alkylene group of X^a , or in the alkyl group of Y^a and Z^a being substituted with fluorine atoms is, the stronger the acid strength is, and thus is preferred. In certain embodiments, the proportion of fluorine atoms in the alkylene group or the alkyl group, i.e., the fluorination rate, ranges from 70% to 100%. In certain embodiments, 15 the proportion of fluorine atoms in the alkylene group or the alkyl group ranges from 90% to 100%. In certain embodiments, the alkylene group or the alkyl group is a perfluoroalkylene group or a perfluoroalkyl group in which all hydrogen atoms are substituted with fluorine atoms.

[00123] In certain embodiments, examples of suitable onium salt having a naphthyl ring in the cation moiety may include compounds represented by Formulas



5 [00124] <Fifth form of photoacid generator (C)>

[00125] Examples of the fifth form of photoacid generator may include:

bissulfonyl diazomethane compound such as bis(4-methylbenzene sulfonyl) diazomethane, bis(1,1-dimethylethyl sulfonyl) diazomethane, bis(cyclohexane sulfonyl) diazomethane, bis(2,4-dimethylbenzene sulfonyl) diazomethane, etc.;

10 nitrobenzyl ester compound such as 4-methylbenzenesulfonic acid 2-nitrobenzyl ester, 4-methylbenzenesulfonic acid 2,6-dinitrobenzyl ester, benzenesulfonic acid nitrobenzyl ester, benzenesulfonic acid dinitrobenzyl ester, sulfonic acid nitrobenzyl ester, carbonic acid nitrobenzyl ester, carbonic acid dinitrobenzyl ester, etc.;

sulfonic ester compound such as pyrogallol trifluoromethanesulfonate,

pyrogallol trimethylbenzenesulfonate, benzenesulfonic acid benzyl ester, sulfonic acid benzyl ester, N-methanesulfonyl oxysuccinimide, N-trichloromethylsulfoxysuccinimide, N-phenylsulfonyloxy maleimide, N-methanesulfonyl 1 oxyphthalimide, etc.; trifluoromethanesulfonic ester compound such as

5 N-hydroxyphthalimide, N-hydroxyphthoimide, etc.; onium salt such as diphenyliodonium hexafluorophosphate, (4-methoxyphenyl)phenyliodonium trifluoromethanesulfonate, bis(tri-tert-butylphenyl)iodonium trifluoromethanesulfonate, triphenyl sulfonium hexafluorophosphate, (4-methoxyphenyl)diphenyl sulfonium trifluoromethanesulfonate, (tri-tert-butylphenyl)

10 diphenyl sulfonium trifluoromethanesulfonate, etc.; benzoin tosylate compound such as methyl benzoin tosylate, α -methyl benzoin tosylate, etc.; and other diphenyl iodonium salts, triphenylsulfonium salts, benzyl diazonium salts, carbonic acid benzyl ester, etc.

[00126] One type of the photoacid generator (C) may be used, or a

15 combination of multiple types of the photoacid generator (C) may be used. In certain embodiments, the photoacid generator (C) is present in an amount ranging from 0.05 wt% to 10 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain

embodiments, the photoacid generator (C) is present in an amount ranging from 0.1 wt% to 9 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the photoacid generator (C) is present in an amount ranging from 0.15 wt% to 8 wt% based on the total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

[00127] <<Solvent component (D)>>

[00128] <Solvent (D1)>

[00129] According to the present disclosure, the solvent component (D) includes a solvent (D1) that has a boiling point ranging from 150°C to 190°C.

[00130] In certain embodiments, examples of the solvent (D1) may include, but are not limited to, 2-heptanone (boiling point of 150°C), ethyl lactate (boiling point of 154°C), cyclohexanone (boiling point of 157°C), 3-methoxybutanol (boiling point of 161°C), 3-methoxybutyl acetate (boiling point of 171°C), cyclohexyl acetate (boiling point of 172°C), dipropyleneglycol dimethyl ether (boiling point of 175°C), diethyleneglycol diethyl ether (boiling point of 188°C), ethylene glycol monobutyl ether acetate (boiling point of 188°C), or any combination of the above.

[00131] <Other solvent (D2)>

[00132] In certain embodiments, the solvent component (D) further includes other solvent (D2) in addition to the solvent (D1).

[00133] Examples of the other solvent (D2) may include, but are not limited to, butyl acetate (abbreviated as "BA"; boiling point of 126°C), cyclopentanone (boiling point of 131°C), ethylene glycol monomethyl ether acetate (boiling point of 145°C), propylene glycol monomethyl ether acetate (boiling point of 146°C), propylene glycol diacetate (boiling point of 191°C), γ -butyrolactone (boiling point of 204°C), dipropylene glycol methyl ether acetate (boiling point of 209°C), diethylene glycol monoethyl ether acetate (boiling point of 218°C), 1,3-butanediol diacetate (boiling point of 232°C), diethylene glycol monobutyl ether acetate (boiling point of 247°C), and glyceryl triacetate (boiling point of 260°C).

[00134] In certain embodiments, the solvent component (D) is present in an amount ranging from 15 wt% to 80 wt% based on a total amount of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the solvent component (D) is present in an amount ranging from 17 wt% to 78 wt% based on the total amount of the chemically-amplified positive-type photosensitive resin composition as 100 wt%. In certain embodiments, the solvent component (D) is present in an amount ranging from 20 wt% to 75 wt% based on

the total amount of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

[00135] According to the present disclosure, when the amount of the solvent (D1) is controlled to be greater than 20 wt% based on a total amount of the solvent component (D), the photosensitive resin layer formed from the chemically-amplified positive-type photosensitive resin composition has better defoaming property. In certain embodiments, the amount of the solvent (D1) ranges from 20 wt% to 100 wt% based on the total amount of the solvent component (D). In certain embodiments, the amount of the solvent (D1) ranges from 23 wt% to 100 wt% based on the total amount of the solvent component (D). In certain embodiments, the amount of the solvent (D1) ranges from 25 wt% to 100 wt% based on the total amount of the solvent component (D).

[00136] When the chemically-amplified positive-type photosensitive resin composition does not include the solvent component (D) including the solvent (D1), the photosensitive resin layer formed from the chemically-amplified positive-type photosensitive resin composition has poor defoaming property.

[00137] <<Additive component (E)>>

[00138] In certain embodiments, the chemically-amplified positive-type

photosensitive resin composition may further include an additive component (E) as long as the effect of the claimed invention is not adversely affected. The additive component (E) includes, but is not limited to, a plasticizer, an adhesion promoter, a surfactant, a sensitizer, an acid diffusion inhibitor, and a thiol compound. One
5 type of the additive component (E) may be used, or a combination of multiple types of the additive component (E) may be used.

[00139] <<Method for preparing chemically-amplified positive-type photosensitive resin composition>>

[00140] According to the present disclosure, the method for preparing the
10 chemically-amplified positive-type photosensitive resin composition is not particularly limited, and the photosensitive resin composition can be prepared by mixing and stirring the aforesaid components in a common manner. Examples of a device that can be used for mixing and stirring the aforesaid components may include a dissolver, a homogenizer, a three-roll mill, etc. After the aforesaid
15 components are uniformly mixed, a mixture thus obtained may be further filtered using a mesh, a membrane filter, etc.

[00141] <<Method for manufacturing composite substrate with casting mold>>

[00142] The method for forming a patterned photoresist as a casting mold for forming an electroplated molded article on a metal surface of a substrate having a metal surface using the aforesaid chemically-amplified positive-type photosensitive resin composition is not particularly limited.

5 [00143] The present disclosure provides a method for manufacturing a composite substrate with a casting mold, which includes a lamination step, an exposure step, and a development step.

[00144] In the lamination step, a photosensitive resin layer composed of the chemically-amplified positive-type photosensitive resin composition is laminated
10 on a metal surface of a substrate having a metal surface. In the exposure step, the photosensitive resin layer is irradiated with actinic rays or radiation, so as to obtain an exposed photosensitive resin layer. In the development step, the exposed photosensitive resin layer is subjected to development, so as to obtain the casting mold for forming an electroplated molded article.

15 [00145] According to the present disclosure, the substrate used for lamination of the photosensitive resin layer thereon is not particularly limited, and an example thereof may include a conventionally known substrate, such as a substrate for electronic components, and a substrate on which a predetermined

wiring pattern is formed. With regard to the substrate of the present disclosure, a substrate having a metal surface is used. In certain embodiments, a metal species constituting the metal surface of the substrate may be copper, gold, or aluminum. In certain embodiments, the metal species is copper.

5 [00146] The photosensitive resin layer is laminated on the substrate as follows: for example, the liquid form of the chemically-amplified positive-type photosensitive resin composition is applied on the substrate, and then the solvent is removed by heating so as to form the photosensitive resin layer with a desired thickness. According to the present disclosure, the thickness of the photosensitive
10 resin layer is not particularly limited, as long as a patterned photoresist can be formed as a template with the desired thickness. In certain embodiments, the thickness of the photosensitive resin layer ranges from 0.5 μm to 150 μm . In certain embodiments, the thickness of the photosensitive resin layer ranges from 1 μm to 140 μm . In certain embodiments, the thickness of the photosensitive resin layer
15 ranges from 2 μm to 130 μm .

 [00147] In certain embodiments, the chemically-amplified positive-type photosensitive resin composition may be coated on the substrate by a coating method such as a spin coating method, a slit coating method, a roll coating method,

a screen printing method, a dispersion method, etc. In certain embodiments, after the lamination step, the photosensitive resin layer is subjected to a pre-baking process. The conditions of the pre-baking process may vary depending on the types and blending ratios of the components in the chemically-amplified positive-type photosensitive resin composition, the thickness of the chemically-amplified positive-type photosensitive resin composition coated, etc. In certain embodiments, the pre-baking process is usually conducted at a temperature ranging from 70°C and 200°C. In certain embodiments, the pre-baking process is conducted at a temperature ranging from 80°C and 150°C for a time period ranging from about 2 minutes to about 60 minutes.

[00148] In the exposure step, the photosensitive resin layer is selectively irradiated (exposed to) with actinic rays or radiation through a mask having a predetermined pattern. For example, the photosensitive resin layer is selectively irradiated with an ultraviolet light or a visible light having a wavelength ranging from 300 nm to 500 nm.

[00149] Examples of radiation source of the aforesaid radiation may include a low-pressure mercury lamp, a high-pressure mercury lamp, an ultra-high-pressure mercury lamp, a metal halide lamp, an argon laser, etc. In certain

embodiments, the radiation is selected from microwave, infrared ray, visible ray, ultraviolet ray, X-ray, γ -ray, electron beam, proton beam, neutron beam, etc. A radiation dose of the radiation may vary depending on the components of the chemically-amplified positive-type photosensitive resin composition, the thickness
5 of the photosensitive resin layer, etc. For example, when the ultra-high-pressure mercury lamp used, the radiation dose of the radiation ranges from 100 mJ/cm² to 10000 mJ/cm². In certain embodiments, the radiation includes a light that activates the photoacid generator (C) so that the photoacid generator (C) is capable of generating an acid.

10 [00150] In certain embodiments, after the photosensitive resin layer is irradiated with actinic rays or radiation, the photosensitive resin layer is heated using a conventional method to promote acid diffusion, so as to alter the alkali solubility of the exposed portion of the photosensitive resin layer.

[00151] In the development step, the exposed photosensitive resin layer is
15 developed according to conventional methods, and a soluble portion thereof is dissolved and removed to form a predetermined patterned photoresist. During the development step, an alkaline aqueous solution may be used as a developing solution.

[00152] With regard to the developing solution, examples of the alkaline aqueous solution may include sodium hydroxide, potassium hydroxide, sodium carbonate, sodium silicate, sodium metasilicate, ammonia water, ethylamine, n-propylamine, diethylamine, di-n-propylamine, trimethylamine, methyl diethylamine, triethanolamine, tetramethylammonium hydroxide, tetraethylammonium hydroxide, pyrrole, piperidine, 1,8-diazabicyclo[5.4.0]-7-undecene, 1,5-diazabicyclo[4.3.0]-5-nonane, etc. In certain embodiments, an aqueous solution that is prepared by adding, to the alkaline aqueous solution, an appropriate amount of a water-soluble organic solvent such as methanol or ethanol, or a surfactant, may be used as the developing solution.

[00153] A time period for conducting the development step may vary depending on the components of the chemically-amplified positive-type photosensitive resin composition, the thickness of the photosensitive resin layer, etc. In certain embodiments, the time period for conducting the development step typically ranges from 1 minute to 30 minutes. The development step may be conducted by any one of a coating method, an immersion method, a paddle method, a spraying method, etc.

[00154] After the development step, rinsing with running water was

conducted for 30 seconds to 90 seconds, and then drying was conducted using an air gun or an oven. Thus, the casting mold which has the patterned photoresist and which is used to form an electroplated molded article may be formed on the metal surface of the substrate having the metal surface, thereby obtaining the composite substrate with the casting mold.

[00155] <<Method for manufacturing electroplated molded article>>

[00156] The present disclosure also provides a method for manufacturing an electroplated molded article, which includes an electroplating step and a stripping step.

[00157] In the electroplating step, the composite substrate with a casting mold manufactured by the aforesaid method for manufacturing a composite substrate with a casting mold is subjected to electroplating, so as to form the electroplated molded article in the casting mold of the composite substrate. In the stripping step, the casting mold is removed with a stripping solution after forming the electroplated molded article.

[00158] To be specific, through embedment of a conductor such as a metal, etc., in the non-photoresist portion (i.e., the portion removed by the developing solution) of the casting mold of the composite substrate with a casting mold by

conducting an electroplating treatment, the electroplated molded article such as a connection terminal, e.g., a bump, a metal column, etc., or a redistribution wiring may be formed. According to the present disclosure, the method for conducting the electroplating treatment is not particularly limited, and various conventional methods may be utilized. Examples of an electroplating material that are particularly suitable to be used in the electroplating treatment may include solder, copper plating solution, gold plating solution, nickel plating solution, etc. After the electroplating treatment is completed, the remaining casting mold may be eventually removed using a stripping solution or the like in accordance with conventional methods.

[00159] In accordance with the method for manufacturing the composite substrate with a casting mold, the casting mold having a patterned photoresist capable of suppressing undercutting can be formed. By using the composite substrate having the casting mold which has the patterned photoresist and which is capable of suppressing undercutting, the electroplated molded article having an excellent adhesion to the composite substrate can be manufactured.

[00160] The present disclosure will be described by way of the following examples. However, it should be understood that the following examples are

intended solely for the purpose of illustration and should not be construed as limiting the present disclosure in practice.

[00161] [Synthesis Example 1] Acid-dissociable resin (A)

[00162] First, nitrogen gas inlet, a stirrer, a heater, a condenser, and a
5 thermometer are installed on a four-necked conical flask with a volume of 1000 mL.
After introduction of nitrogen gas, 50 parts by weight of propylene glycol
monomethyl ether acetate (abbreviated as "PGMEA" hereinafter, serving as a
solvent) were added, and the oil bath temperature was raised to 70°C. Next, 30
parts by weight of compound a11, 25 parts by weight of compound a21, 10 parts
10 by weight of compound a31, 10 parts by weight of compound a32, 25 parts by
weight of compound a33, and 3.5 parts by weight of 2,2'-azobis-2-
methylbutyronitrile (abbreviated as "AMBN" hereinafter, serving as a catalyst) were
added into the four-necked conical flask, and followed by slow stirring to allow a
polycondensation reaction to proceed. The polycondensation reaction was
15 conducted at a reaction temperature that was maintained at 70°C, and at a reaction
time period that lasted 6 hours. After completion of the polycondensation reaction,
a polycondensation product was taken out from the four-necked conical flask, and
the solvent is removed, thereby obtaining an acid-dissociable resin (A) of Synthesis

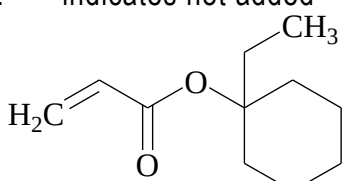
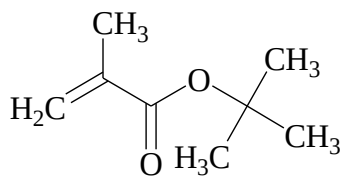
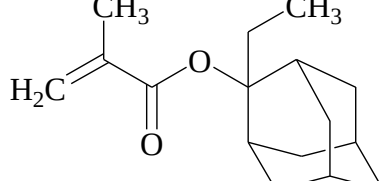
Example 1.

[00163] [Synthesis Examples 2 to 5] Acid-dissociable resin (A)

[00164] The procedures and conditions for preparing a respective one of the acid-dissociable resin (A) of Synthesis Examples 2 to 5 were similar to those of Synthesis Example 1, except that in Synthesis Examples 2 to 5, the type and amount of each of the monomer (a1) having a structure represented by Formula (A-1), the monomer (a2) containing a polyoxyalkylene chain, and the other monomer (a3), the amount of propylene glycol monomethyl ether acetate, the type and amount of the catalyst, and the reaction temperature and reaction time period of the polycondensation reaction were varied, as shown in Table 1 below.

[00165] Table 1

Unit: parts by weight		Synthesis Example				
		1	2	3	4	5
Monomer (a1) having a structure represented by Formula (A-1)	a11	30	--	--	35	--
	a12	--	25	--	--	40
	a13	--	--	20	--	--
Monomer (a2) containing polyoxyalkylene chain	a21	25	--	--	20	--
	a22	--	15	--	--	30
	a23	--	--	35	--	--
Other monomer (a3)	a31	10	--	25	5	--
	a32	10	20	--	15	--
	a33	25	30	20	25	25
	a34	--	10	--	--	5
Solvent	PGMEA	50	55	60	55	60
Catalyst	AMBN	3.5	--	--	3.0	4.0
	ADVN	--	4.0	3.0	0.5	--
Polycondensation	Temperature (°C)	70	65	70	75	70

reaction	Time period (hours)	6	7	6	6	6
Note: "--" indicates not added a11:  a12:  a13:  a21: (ethyl-diethylene glycol) acrylate a22: (2-ethylhexyl-polyethylene) acrylate a23: (phenoxy-polyethylene glycol) acrylate a31: methacrylate a32: methyl methacrylate a33: benzyl methacrylate a34: 2-hydroxyethyl methacrylate PGMEA: propylene glycol monomethyl ether acetate AMBN: 2,2'-azobis-2-methylbutyronitrile ADV: 2,2'-azobis(2,4-dimethylvaleronitrile)						

[00166] [Synthesis Example 6] Novolac resin (B1)

[00167] First, nitrogen gas inlet, a stirrer, a heater, a condenser, and a thermometer are installed on a four-necked conical flask with a volume of 1000 mL. After introduction of nitrogen gas, 0.50 mol of m-cresol, 0.50 mol of p-cresol, 0.65 mol of formaldehyde, and 0.200 mol of oxalic acid (serving as a catalyst) were added into the four-necked conical flask so as to obtain a reaction solution. Next, the reaction solution was slowly stirred and a temperature thereof was raised to

100°C, so as to allow the reaction solution to be subjected to a polycondensation reaction at 100°C for 6 hours. After the polycondensation reaction was completed, the temperature of the reaction solution was raised to 180°C, followed by drying under reduced pressure at a pressure of 10 mmHg to remove solvent, so as to obtain a novolac resin (B1) of Synthesis Example 6.

[00168] [Synthesis Examples 7 to 10] Novolac resin (B1)

[00169] The procedures and conditions for preparing a respective one of the novolac resin (B1) of Synthesis Examples 7 to 10 were similar to those of Synthesis Example 6, except that in Synthesis Examples 7 to 10, the types and amounts of the reactants, the amount of oxalic acid, and the reaction temperature and reaction time period of the polycondensation reaction were varied, as shown in Table 2 below.

[00170] Table 2

Unit: mol		Synthesis Example				
		6	7	8	9	10
Aromatic hydroxyl compound	o-cresol	--	--	--	0.02	--
	m-cresol	0.50	0.45	0.60	0.50	0.40
	p-cresol	0.50	0.55	0.40	0.48	0.50
	2,5-dimethylphenol	--	--	--	--	0.10
Aldehyde	Formaldehyde	0.65	--	0.65	0.65	--
	Benzaldehyde	--	0.70	--	--	0.65
Catalyst	Oxalic acid	0.200	0.015	0.020	0.020	0.020
Polycondensation reaction	Temperature (°C)	100	100	100	95	100
	Time period	6	6	6	6	6

	(hours)					
Note: "--" indicates not added						

[00171] [Synthesis Example 11] Acrylic resin (B3)

[00172] First, nitrogen gas inlet, a stirrer, a heater, a condenser, and a thermometer are installed on a four-necked conical flask with a volume of 1000 mL. After nitrogen gas was introduced, 55 parts by weight of PGMEA (serving as a solvent) was added, and the oil bath temperature was raised to 70°C. Next, 20 parts by weight of methacrylic acid, 20 parts by weight of methyl methacrylate, 30 parts by weight of benzyl methacrylate, 30 parts by weight of 2-hydroxyethyl methacrylate, and 4.5 parts by weight of AMBN (serving as a catalyst) were added into the four-necked conical flask, followed by slow stirring to allow a polycondensation reaction to proceed. The polycondensation reaction was conducted at a reaction temperature that was maintained at 75°C, and at a reaction time period that lasted 5 hours. After completion of the polycondensation reaction, a polycondensation product was taken out from the four-necked conical flask, and the solvent is removed, thereby obtaining an acrylic resin (B3) of Synthesis Example 11.

[00173] [Example 1] Chemically-amplified positive-type photosensitive resin composition

[00174] 35.0 parts by weight of the acid-dissociable resin (A) of Synthesis Example 1, 64.7 parts by weight of the acrylic resin (B3) of Synthesis Example 11 [serving as the alkali-soluble resin (B)], 0.3 parts by weight of the photoacid generator C-1, 20 parts by weight of the solvent D1-1, and 330 parts by weight of the other solvent D2-1 were mixed, and the acid-dissociable resin (A) of Synthesis Example 1, the acrylic resin (B3) of Synthesis Example 11 and the photoacid generator C-1 were dissolved using a shaking mixer, thereby obtaining a chemically-amplified positive-type photosensitive resin composition of Example 1, as shown in Table 3 below.

[00175] [Examples 2 to 8 and Comparative Examples 1 to 4] Chemically-amplified positive-type photosensitive resin composition

[00176] The procedures and conditions for preparing a respective one of the chemically-amplified positive-type photosensitive resin compositions of Examples 2 to 8 and Comparative Examples 1 to 4 were similar as those of Example 1, except that in Examples 2 to 8 and Comparative Examples 1 to 4, the type and amount of the acid-dissociable resin (A), the type and amount of the alkali-soluble resin (B), the type and amount of the photoacid generator (C), and the type and amount of the solvent component (D) were varied, as shown in Tables 3 and 4 below. To be

specific, novolac resin (B1) was used as the alkali-soluble resin in Example 2, novolac resin (B1) and polyhydroxystyrene resin (B2) were used as the alkali-soluble resin in each of Examples 3 to 7, and polyhydroxystyrene resin (B2) was used as the alkali-soluble resin in Example 8.

5 [00177] [Property Evaluation]

[00178] A respective one of the chemically-amplified positive-type photosensitive resin compositions of Examples 1 to 8 and Comparative Examples 1 to 4 was subjected to evaluation of different properties as described below.

1. Ratio of signal intensity of –OH group (I_{OH}) to signal intensity of C=O group (I_{CO}) of dry film

10

[00179] A respective one of the chemically-amplified positive-type photosensitive resin compositions of Examples 1 to 8 and Comparative Examples 1 to 4 was coated on a surface of a substrate to form a coating film. Next, the coating film was subjected to baking at 140°C for 600 seconds so as to obtain a dry film having a thickness of 50 μm . Afterwards, a portion of the dry film was crushed to be prepared as a test material, and then the test material was subjected to Fourier transform infrared spectroscopy (FTIR) measurement using a FTIR spectrophotometer (Manufacturer: Thermo Fisher Scientific Inc.; Model number:

15

NICOLET 6700; Analysis software: OMNIC) so as to obtain a FITR spectrum of the sample. In the FITR spectrum, a signal intensity of a peak near a wavenumber of 3374 cm^{-1} was taken as a signal intensity derived from the -OH group and was defined as I_{OH} , whereas a signal intensity of a peak near a wavenumber of 1727 cm^{-1} was taken as a signal intensity derived from the C=O group and was defined as I_{CO} . Finally, a ratio of a signal intensity of -OH group to a signal intensity of C=O group was calculated using I_{OH} and I_{CO} , i.e., $I_{\text{OH}}/I_{\text{CO}}$.

2. Defoaming property

[00180] A respective one of the chemically-amplified positive-type photosensitive resin compositions of Examples 1 to 8 and Comparative Examples 1 to 4 was coated on a surface of a 12-inch copper substrate using a spin coated so as to form a photosensitive resin layer having a thickness of 50 μm . Next, the copper substrate with the photosensitive resin layer formed on the surface thereof was placed in an environment with a temperature of 140°C, and subjected to a pre-baking process for 5 minutes. Thereafter, the number of bubbles having a diameter of not less than 100 μm on the surface of the photosensitive resin layer was visually observed and counted. The smaller the number of bubbles is, the better the defoaming property of the photosensitive resin layer is. The different ranges of the

number of bubbles having a diameter of not less than 100 μm on the surface of the photosensitive resin layer are indicated with different symbols as follows:

◎ : number of bubbles < 50

O : $50 \leq$ number of bubbles < 80

5 Δ : $80 \leq$ number of bubbles < 100

$\times$: number of bubbles ≥ 100

3. Rectangularity property

[00181] A respective one of the chemically-amplified positive-type photosensitive resin compositions of Examples 1 to 8 and Comparative Examples 1 to 4 was coated on a surface of a 12-inch copper substrate using a spin coated so as to form a photosensitive resin layer having a thickness of 50 μm . Next, the copper substrate with the photosensitive resin layer formed on the surface thereof was placed in an environment with a temperature of 140°C, and subjected to a pre-baking process for 5 minutes. After completion of the pre-baking process, the photosensitive resin layer subjected to exposure (i.e., irradiated) using an i-line exposure machine through a photomask at an exposure dose of 150 mJ/cm² so as to form an exposed photosensitive resin layer. Then, the copper substrate with the exposed photosensitive resin layer formed on the surface thereof was placed on a

heating plate set at 100°C, such that the exposed photosensitive resin layer is subjected to post-exposure baking for 3 minutes. Thereafter, a tetramethylammonium hydroxide aqueous solution containing tetramethylammonium hydroxide (abbreviated as "TMAH" hereinafter) at a concentration of 2.38 wt% was dropwise added onto the exposed photosensitive resin layer, followed by left to stand at 23°C for 60 seconds; and this procedure was repeated four times to allow the exposed photosensitive resin layer to be subjected to development. After completion of development, the copper substrate was subjected to cleaning with running water and then blown with nitrogen gas so as to obtain a composite substrate that includes the copper substrate and a patterned photoresist layer which was formed on the surface of the copper substrate, and on which a patterned photoresist was formed.

[00182] FIG. 1 is a schematic view illustrating measurement of rectangularity of the patterned photoresist. The photosensitive resin layer coated on a substrate 11, after being subjected to the aforesaid exposure and development steps, formed a patterned photoresist layer 12 having a photoresist portion 121 and a non-photoresist portion 122. The cross-sectional shape of the patterned photoresist layer 12 was observed, and a bottom width (L_b) of the non-photoresist

portion 122 and a top width (L_t) of the non-photoresist portion 122 were measured.

A ratio of the top width to the bottom width (i.e., L_t/L_b) was calculated as an index for determining the rectangularity of the patterned photoresist. The closer the ratio of the top width to the bottom width (i.e., L_t/L_b) is, the better the rectangularity of the patterned photoresist is. The different ranges of the ratio of the top width to the bottom width (i.e., L_t/L_b) of the non-photoresist portion 122 are indicated with different symbols as follows:

◎ : $0.9 < L_t/L_b < 1.1$

O : $0.85 < L_t/L_b \leq 0.9$; $1.1 \leq L_t/L_b < 1.15$

△ : $0.75 < L_t/L_b \leq 0.85$; $1.15 \leq L_t/L_b < 1.25$

× : $L_t/L_b < 0.75$; $L_t/L_b > 1.25$

4. Electroplating resistance property

[00183] The composite substrate, which had been subjected to determination of rectangularity as described above, was subjected to ashing treatment using oxygen plasma. Next, the ash-treated composite substrate was immersed in a gold sulfite electroplating solution at a temperature of 65°C for 40 minutes. After washing with running water, the extent of shape change of the patterned photoresist of the patterned photoresist layer was observed using an

optical microscope. The bottom width change rate (ΔL_b) and the top width change rate (ΔL_t) of the non-photoresist portion of the patterned photoresist layer were calculated as a basis for evaluation of electroplating resistance. The smaller the bottom width change rate (ΔL_b) and the top width change rate (ΔL_t) are, the better the electroplating resistance of the patterned photoresist is. The different ranges of the bottom width change rate (ΔL_b) and the top width change rate (ΔL_t) of the non-photoresist portion of the patterned photoresist layer are indicated with different symbols as follows:

◎ : $0\% < \Delta L_b \leq 0.5\%$ and $0\% < \Delta L_t \leq 0.5\%$

○ : $0.5\% < \Delta L_b \leq 3\%$ and $\Delta L_t \leq 3\%$; $0.5\% < \Delta L_t \leq 3\%$ and $\Delta L_b \leq 3\%$

△ : $3\% < \Delta L_b \leq 5\%$ and $\Delta L_t \leq 5\%$; $3\% < \Delta L_t \leq 5\%$ and $\Delta L_b \leq 5\%$

× : $\Delta L_b > 5\%$ or $\Delta L_t > 5\%$

[00184] Table 3

Unit: Parts by weight			Example			
			1	2	3	4
Acid-dissociable resin (A)	Synthesis Example		1	35.0	--	--
			2	--	40.2	--
			3	--	--	49.6
			4	--	--	55.0
			5	--	--	--
Alkali-soluble resin (B)	Novolac resin (B1)	Synthesis Example	6	--	59.7	--
			7	--	--	49.6
			8	--	--	43.7
			9	--	--	--

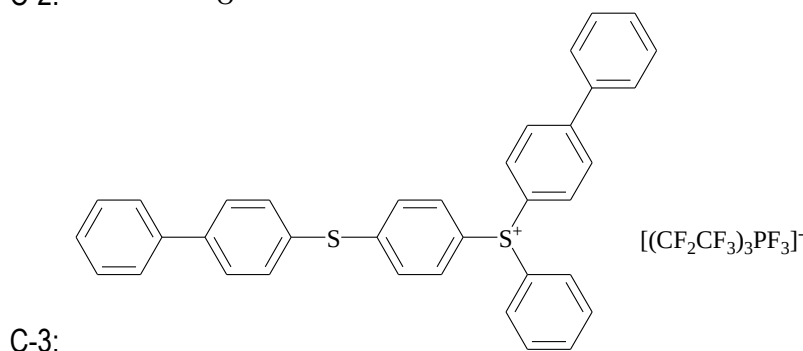
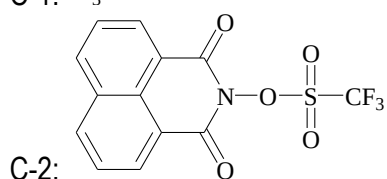
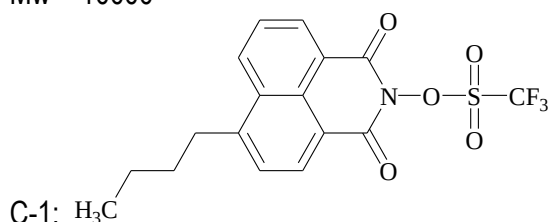
			10	--	--	--	--
	Polyhydroxystyrene resin (B2)	B2-1		--	--	0.6	1.0
		B2-2		--	--	--	--
		B2-3		--	--	--	--
	Acrylic resin (B3)	Synthesis Example 11		64.7	--	--	--
Photoacid generator (C)	C-1			0.3	0.1	0.2	0.3
	C-2			--	--	--	--
	C-3			--	--	--	--
Solvent component (D)	Solvent (D1)	D1-1		20	40	35	185
		D1-2		--	--	60	--
		D1-3		--	--	--	--
	Other solvent (D2)	D2-1		330	195	5	--
	Amount of D1 (wt%)			5.7	17.0	95.0	100.0
I _{OH} /I _{CO}				0.13	0.65	0.55	0.46
Property evaluation	Defoaming property			0	0	◎	◎
	Rectangularity property			0	0	◎	◎
	Electroplating resistance property			0	◎	◎	◎

Note: "--" indicates not added

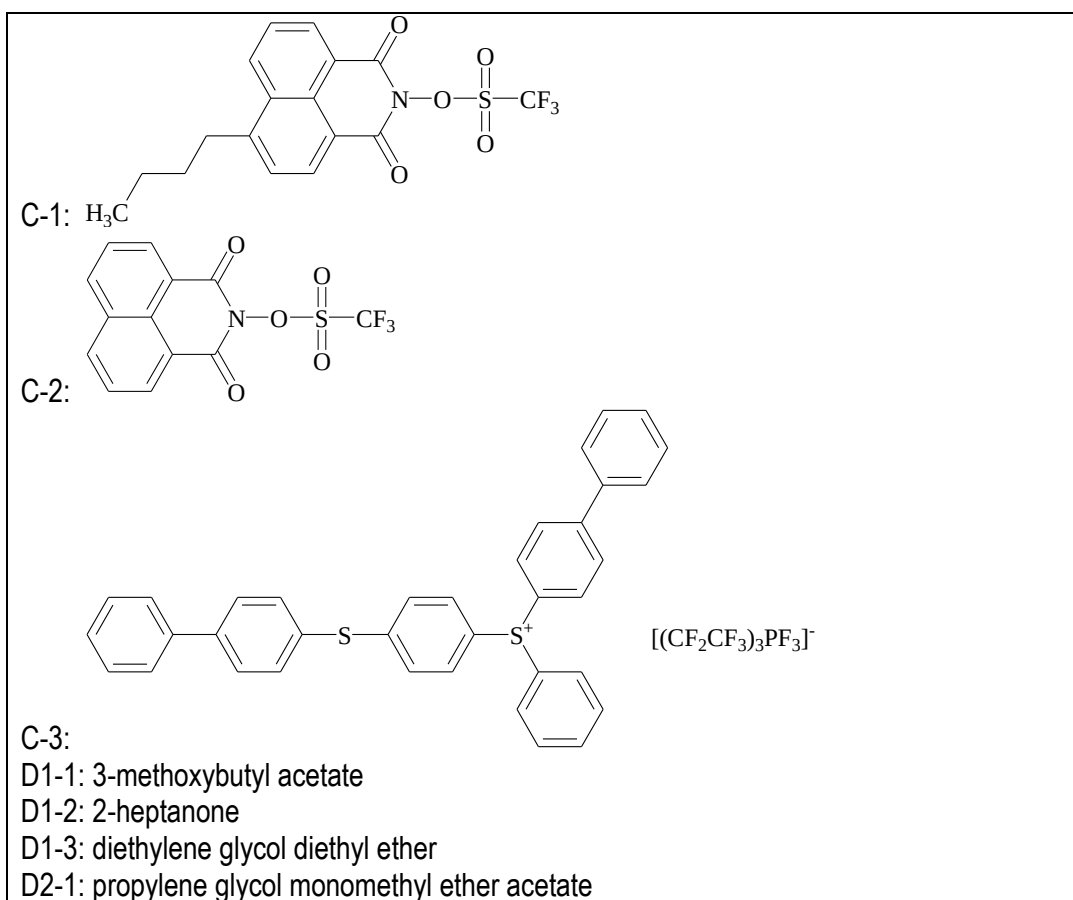
B2-1: p-hydroxystyrene = 100 (mass ratio) copolymer, Mw = 5000

B2-2: p-hydroxystyrene/styrene = 85/15 (mass ratio) copolymer, Mw = 2500

B2-3: p-hydroxystyrene/styrene/tert-butyl acrylate = 60/25/15 (mass ratio) copolymer, Mw = 10000



Unit: Parts by weight			Example					
			5	6	7	8		
Acid-dissociable resin (A)	Synthesis Example		1	--	45.0	57.5	70	
			2	--	--	--	--	
			3	--	--	--	--	
			4	--	--	--	--	
			5	48.5	--	--	--	
Alkali-soluble resin (B)	Novolac resin (B1)	Synthesis Example	6	--	--	41.7	--	
			7	--	--	--	--	
			8	--	--	--	--	
			9	50.8	--	--	--	
			10	--	53.7	--	--	
	Polyhydroxystyrene resin (B2)	B2-1		--	--	0.7	0.3	
		B2-2		0.5	--	--	--	
		B2-3		--	0.8	--	--	
	Acrylic resin (B3)		Synthesis Example 11		--	--	--	29.1
	Photoacid generator (C)	C-1		0.2	--	--	0.6	
C-2		--	0.5	--	--			
C-3		--	--	0.1	--			
Solvent component (D)	Solvent (D1)	D1-1	18	--	32	30		
		D1-2	--	--	10	--		
		D1-3	--	45	--	--		
	Other solvent (D2)	D2-1	32	50	66	250		
	Amount of D1 (wt%)		36.0	47.4	38.9	10.7		
I _{OH} /I _{CO}			0.56	0.59	0.42	0.17		
Property evaluation	Defoaming property		◎	◎	◎	○		
	Rectangularity property		◎	◎	◎	◎		
	Electroplating resistance property		◎	◎	◎	○		
Note: "--" indicates not added								
B2-1: p-hydroxystyrene = 100 (mass ratio) copolymer, Mw = 5000								
B2-2: p-hydroxystyrene/styrene = 85/15 (mass ratio) copolymer, Mw = 2500								
B2-3: p-hydroxystyrene/styrene/tert-butyl acrylate = 60/25/15 (mass ratio) copolymer, Mw = 10000								



[00186] Table 5

Unit: Parts by weight				Comparative Example			
				1	2	3	4
Acid-dissociable resin (A)	Synthesis Example		1	99.8	--	44.0	--
			2	--	--	--	99.6
			3	--	--	--	--
			4	--	--	--	--
			5	--	--	--	--
Alkali-soluble resin (B)	Novolac resin (B1)	Synthesis Example	6	--	--	--	--
			7	--	--	--	--
			8	--	--	--	--
			9	--	--	--	--
			10	--	--	--	--
	Polyhydroxystyrene resin (B2)	B2-1	--	--	--	--	--
		B2-2	--	--	--	--	--
		B2-3	--	--	--	--	--
	Acrylic resin (B3)	Synthesis Example 11	--	99.7	55.5	--	--

Photoacid generator (C)	C-1		0.2	0.3	--	--
	C-2		--	--	0.5	--
	C-3		--	--	--	0.4
Solvent component (D)	Solvent (D1)	D1-1	20	--	--	--
		D1-2	--	15	--	--
		D1-3	--	--	--	--
	Other solvent (D2)	D2-1	130	85	200	130
	Amount of D1 (wt%)		13.3	15.0	0	0
I _{OH} /I _{CO}			0.02	0.16	0.12	0.01
Property evaluation	Defoaming property		0	0	×	×
	Rectangularity property		0	×	0	0
	Electroplating resistance property		×	0	0	×

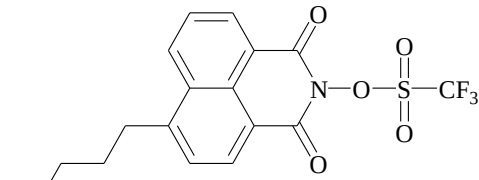
Note: "--" indicates not added

B2-1: p-hydroxystyrene = 100 (mass ratio) copolymer, Mw = 5000

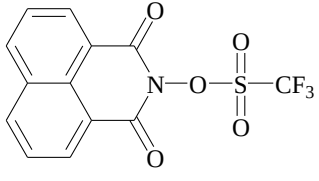
B2-2: p-hydroxystyrene/styrene = 85/15 (mass ratio) copolymer, Mw = 2500

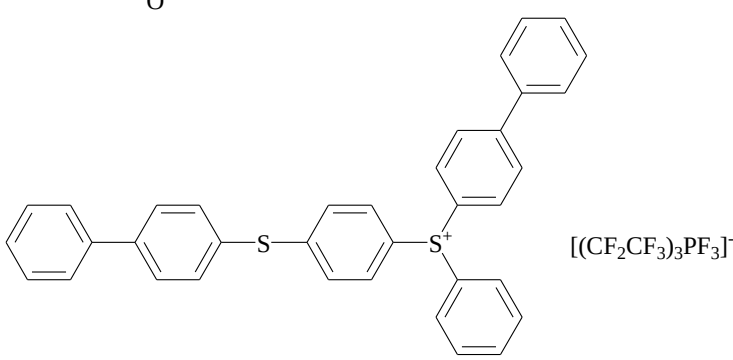
B2-3: p-hydroxystyrene/styrene/tert-butyl acrylate = 60/25/15 (mass ratio) copolymer, Mw = 10000

C-1:



C-2:





[(CF₂CF₃)₃PF₃]⁻

C-3:

D1-1: 3-methoxybutyl acetate

D1-2: 2-heptanone

D1-3: diethylene glycol diethyl ether

D2-1: propylene glycol monomethyl ether acetate

[00187] Referring to Tables 3 and 4, the chemically-amplified positive-type

photosensitive resin compositions of Examples 1 to 8 include the acid-dissociable resin (A), the alkali-soluble resin (B), and the solvent component (D), and the ratios of the signal intensity of the hydroxy (-OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}) of the dry films formed from such chemically-amplified positive-type photosensitive resin compositions, as measured by FTIR, range from 0.12 to 0.9. Therefore, the photosensitive resin layers formed from the chemically-amplified positive-type photosensitive resin compositions of Examples 1 to 8 have good defoaming property, and the patterned photoresist layers formed from these chemically-amplified positive-type photosensitive resin compositions also simultaneously exhibit good rectangularity and good electroplating resistance.

[00188] In contrast, the alkali-soluble resin (B) is not included in the chemically-amplified positive-type photosensitive resin composition of Comparative Example 1, and the ratio of the signal intensity of the hydroxy (-OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}) of the dry film formed from such chemically-amplified positive-type photosensitive resin composition, as measured by FTIR, is 0.02, which is outside the range of 0.12 to 0.9. Therefore, the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition of Comparative Example

1 has poor electroplating resistance. In addition, the acid-dissociable resin (A) is not included in the chemically-amplified positive-type photosensitive resin composition of Comparative Example 2, and thus the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition of Comparative Example 2 has poor rectangularity. Moreover, the solvent (D1) of the solvent component (D) is not included in the chemically-amplified positive-type photosensitive resin composition of Comparative Example 3, and thus the photosensitive resin layer formed from the chemically-amplified positive-type photosensitive resin composition of Comparative Example 3 has poor defoaming property. Further, the alkali-soluble resin (B) and the solvent (D1) of the solvent component (D) are not included in the chemically-amplified positive-type photosensitive resin composition of Comparative Example 4, and the ratio of the signal intensity of the hydroxy (-OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}) of the dry film formed from such chemically-amplified positive-type photosensitive resin composition, as measured by FTIR, is 0.01, which is outside the range of 0.12 to 0.9. Therefore, the photosensitive resin layer formed from the chemically-amplified positive-type photosensitive resin composition of Comparative Example 4 has poor defoaming property, and the

patterned photoresist layer formed from such chemically-amplified positive-type photosensitive resin composition has poor electroplating resistance.

[00189] On the other hand, the chemically-amplified positive-type photosensitive resin composition of Examples 2 to 7 further include the novolac resin (B1) of the alkali-soluble resin (B), and the ratios of the signal intensity of the hydroxy (-OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}) of the dry films formed from the chemically-amplified positive-type photosensitive resin compositions of Examples 2 to 7, as measured by FTIR, range from 0.16 to 0.85. Therefore, the patterned photoresist layers formed from the chemically-amplified positive-type photosensitive resin compositions of Examples 2 to 7 have better electroplating resistance. In addition, the chemically-amplified positive-type photosensitive resin composition of Examples 3 to 8 further include the polyhydroxystyrene resin (B2) of the alkali-soluble resin (B), and thus the patterned photoresist layers formed from the chemically-amplified positive-type photosensitive resin compositions of Examples 3 to 8 have better rectangularity. Moreover, the amounts of solvent (D1) of the solvent component (D) in the chemically-amplified positive-type photosensitive resin compositions of Examples 3 to 7 are controlled to be not less than 20 wt%, and thus the photosensitive resin

layers formed from the chemically-amplified positive-type photosensitive resin compositions of Examples 3 to 7 have better defoaming property.

[00190] In summary, by inclusion of the acid-dissociable resin (A), the alkali-soluble resin (B) and the solvent (D1) of the solvent component (D) in the chemically-amplified positive-type photosensitive resin composition of the present disclosure, and by having the ratio of the signal intensity of the hydroxy (-OH) group (I_{OH}) to the signal intensity of the carbonyl (C=O) group (I_{CO}) of the dry film formed from the chemically-amplified positive-type photosensitive resin composition, as measured by FTIR, ranging from 0.12 to 0.9, the photosensitive resin layer formed from the chemically-amplified positive-type photosensitive resin composition has good defoaming property, and the patterned photoresist layer formed from the chemically-amplified positive-type photosensitive resin composition also has good rectangularity and good electroplating resistance. Therefore, the purpose of the present disclosure can indeed be achieved.

[00191] In the description above, for the purposes of explanation, numerous specific details have been set forth in order to provide a thorough understanding of the embodiment(s). It will be apparent, however, to one skilled in the art, that one or more other embodiments may be practiced without some of these specific

details. It should also be appreciated that reference throughout this specification to “one embodiment,” “an embodiment,” an embodiment with an indication of an ordinal number and so forth means that a particular feature, structure, or characteristic may be included in the practice of the disclosure. It should be further

5 appreciated that in the description, various features are sometimes grouped together in a single embodiment, figure, or description thereof for the purpose of streamlining the disclosure and aiding in the understanding of various inventive aspects; such does not mean that every one of these features needs to be practiced with the presence of all the other features. In other words, in any described

10 embodiment, when implementation of one or more features or specific details does not affect implementation of another one or more features or specific details, said one or more features may be singled out and practiced alone without said another one or more features or specific details. It should be further noted that one or more features or specific details from one embodiment may be practiced together with

15 one or more features or specific details from another embodiment, where appropriate, in the practice of the disclosure.

[00192] While the disclosure has been described in connection with what is (are) considered the exemplary embodiment(s), it is understood that this disclosure

is not limited to the disclosed embodiment(s) but is intended to cover various arrangements included within the spirit and scope of the broadest interpretation so as to encompass all such modifications and equivalent arrangements.

CLAIMS

1. A chemically-amplified positive-type photosensitive resin composition, characterized by:

an acid-dissociable resin (A);

5 an alkali-soluble resin (B);

a photoacid generator (C); and

a solvent component (D);

wherein the solvent component (D) includes a solvent (D1) that has a boiling point ranging from 150°C to 190°C, a dry film formed from the chemically-amplified positive-type photosensitive resin composition being subjected to Fourier transform infrared spectroscopy (FTIR) measurement, a ratio of a signal intensity of a hydroxy (—OH) group (I_{OH}) to a signal intensity of a carbonyl (C=O) group (I_{CO}) of the dry film ranging from 0.12 to 0.9.

10

2. The chemically-amplified positive-type photosensitive resin composition as claimed in claim 1, characterized in that the ratio of the signal intensity of the —OH group (I_{OH}) to the signal intensity of the C=O group (I_{CO}) of the dry film is determined by the steps of:

15

coating the chemically-amplified positive-type photosensitive resin

composition on a substrate to form a coating film of the chemically-amplified positive-type photosensitive resin composition;

baking the coating film to obtain a dry film;

crushing a portion of the dry film to prepare a test material, and then

5 subjecting the test material to Fourier transform infrared spectroscopy (FTIR) measurement so as to obtain an FTIR spectrum of the test material; and

10 defining I_{OH} as the signal intensity derived from the $-OH$ group at a wavenumber of 3374 cm^{-1} in the FTIR spectrum, and defining I_{CO} as the signal intensity derived from the $C=O$ group at a wavenumber of 1727 cm^{-1} in the FTIR spectrum.

3. The chemically-amplified positive-type photosensitive resin composition as claimed in claim 1, characterized in that the ratio of the signal intensity of the $-OH$ group (I_{OH}) to the signal intensity of the $C=O$ group (I_{CO}) of the dry film ranges from 0.16 to 0.85.

15 4. The chemically-amplified positive-type photosensitive resin composition as claimed in claim 1, characterized in that the ratio of the signal intensity of the $-OH$ group (I_{OH}) to the signal intensity of the $C=O$ group (I_{CO}) of the dry film ranges from 0.2 to 0.8.

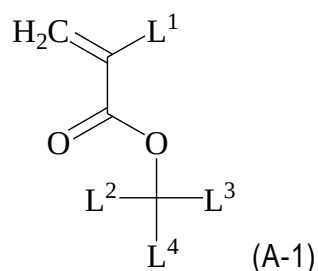
5. The chemically-amplified positive-type photosensitive resin composition as claimed in claim 1, characterized in that

the acid-dissociable resin (A) is present in an amount ranging from 25 wt% to 75 wt%, the alkali-soluble resin (B) is present in an amount ranging from 20 wt% to 70 wt%, and the photoacid generator (C) is present in an amount ranging from 0.05 wt% to 10 wt% based on a total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%,

the solvent component (D) is present in an amount ranging from 15 wt% to 80 wt% based on a total amount of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

6. The chemically-amplified positive-type photosensitive resin composition as claimed in claim 1, characterized in that the acid-dissociable resin (A) is obtained by subjecting a monomer mixture to a copolymerization reaction, the monomer mixture including a monomer (a1) having a structure represented by Formula (A-

1),



wherein in Formula (A-1),

L¹ is a hydrogen atom, a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms, a fluorine atom, or a linear fluorinated alkyl group or a branched fluorinated alkyl group having 1 to 6 carbon atoms; and

each of L², L³ and L⁴ is independently a linear alkyl group or a branched alkyl group having 1 to 6 carbon atoms, or a linear fluorinated alkyl group or a branched fluorinated alkyl group having 1 to 6 carbon atoms, or alternatively, L³ and L⁴ are bonded to each other to form a hydrocarbon ring having 5 to 20 carbon atoms.

7. The chemically-amplified positive-type photosensitive resin composition as claimed in claim 1, characterized in that the alkali-soluble resin (B) includes a novolac resin (B1), a polyhydroxystyrene resin (B2), or a combination thereof.

8. The chemically-amplified positive-type photosensitive resin composition as claimed in claim 7, characterized in that the alkali-soluble resin (B) includes the

novolac resin (B1) which is present in an amount ranging from 20 wt% to 65 wt% based on a total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

9. The chemically-amplified positive-type photosensitive resin composition as
5 claimed in claim 7, characterized in that the alkali-soluble resin (B) includes the polyhydroxystyrene resin (B2) which is present in an amount ranging from 0.2 wt% to 5 wt% based on a total solid content of the chemically-amplified positive-type photosensitive resin composition as 100 wt%.

10. The chemically-amplified positive-type photosensitive resin composition as
10 claimed in claim 1, characterized in that the solvent (D1) is present in an amount ranging from 20 wt% to 100 wt% based on a total amount of the solvent component (D) as 100 wt%.

11. A method for manufacturing a composite substrate with a casting mold, characterized by:

15 a lamination step, in which a photosensitive resin layer composed of a chemically-amplified positive-type photosensitive resin composition as claimed in any one of claims 1 to 10 is laminated on a metal surface of a substrate;

an exposure step, in which the photosensitive resin layer is irradiated

with actinic rays or radiation, so as to obtain an exposed photosensitive resin layer;

and

a development step, in which the exposed photosensitive resin layer is subjected to development, so as to obtain the casting mold for forming an

5 electroplated molded article.

12. A method for manufacturing an electroplated molded article, characterized by:

an electroplating step, in which a composite substrate with a casting mold manufactured by a method for manufacturing a composite substrate with a

10 casting mold as claimed in claim 11 is subjected to electroplating, so as to form the electroplated molded article in the casting mold of the composite substrate; and

a stripping step, in which the casting mold is removed with a stripping solution after forming the electroplated molded article.