a C_1 to C_4 alkyl group, R^3 represents a single bond or a C_1 to C_{10} alkylene group, and R^4 represents a u-valence organic group; and u represents an integer of 2 to 6.

[0013] In an embodiment of the invention, the chemically-amplified positive photosensitive resin composition further includes an anthracene compound (F).

[0014] In an embodiment of the invention, based on a total amount of 100 parts by weight of the resin (A), the amount of the novolac resin (B) is 20 parts by weight to 150 parts by weight, the amount of the photoacid generator (C) is 0.5 parts by weight to 5 parts by weight, and the amount of the solvent (D) is 30 parts by weight to 360 parts by weight.

[0015] In an embodiment of the invention, based on a total amount of 100 parts by weight of the monomer mixture, the amount of the monomer (al) is 10 parts by weight to 60 parts by weight.

[0016] In an embodiment of the invention, based on a total amount of 100 parts by weight of the monomer mixture, the amount of the monomer (a2) is 5 parts by weight to 35 parts by weight.

[0017] In an embodiment of the invention, based on a total amount of 100 parts by weight of the resin (A), the amount of the thiol compound (E) is 0.3 parts by weight to 3 parts by weight.

[0018[In an embodiment of the invention, based on a total amount of 100 parts by weight of the resin (A), the amount of the anthracene compound (F) is 0.2 parts by weight to 1.5 parts by weight.

[0019] The invention also provides a manufacturing method of a substrate with a casting mold, including: a lamination step, laminating a photosensitive resin layer

temperature of 40 °C, a measurement time of 60 minutes, and polystyrene as the molecular weight standard.

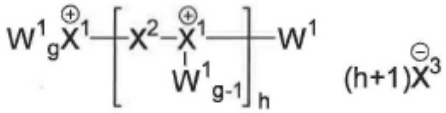
[0067] The weight-average molecular weight of the novolac resin (B) is 4,000 to 36,000; preferably 5,000 to 30,000; and more preferably 6,000 to 24,000.

[0068] Based on a total amount of 100 parts by weight of the resin (A), the amount of the novolac resin (B) is 20 parts by weight to 150 parts by weight, preferably 25 parts by weight to 140 parts by weight, and more preferably 30 parts by weight to 130 parts by weight.

Photoacid generator (C)

[0069] The photoacid generator (C) is a compound generating acid via actinic ray or radiation and is not particularly limited as long as it is a compound that can directly or indirectly generate acid via light. The photoacid generator (C) is preferably an acid generator of the first to fifth forms described below. In the following, the first to fifth forms of the photoacid generator (C) suitable for the photosensitive resin composition are described.

[0070] The first form of the photoacid generator (C) can include a compound represented by formula (C-l) below:



formula (C-1)

In formula (C-l), X^1 represents a g-valence sulfur atom or iodine atom, and g is 1 or 2. h represents the number of repeating units of the structure in the parenthesis. W^1 is an organic group bonded to X^1, and represents a C_6 to C_{30} aryl group, a C_4 to C_{30}

phenylmethyl toluenesulfonate, benzyl sulfonate, N-methanesulfonyl oxysuecinimide, N-trichloromethylsulfoxysuccinimide, N-phenylsulfonyloxy maleimide, or N-methanesulfonyloxyphthalimide; trifluoromethanesulfonate such as N-hydroxyphthalimide or N-hydroxynaphthyl imide; onium salt such as diphenylphosphonium hexafluorophosphate, (4-methoxyphenyl)phenyl trifluoromethanesulfonate, bis(p-tert-butyIphenyl)iodonium triflate, triphenylphosphonium hexafluorophosphate, (4-methoxyphenyl)diphenylphosphonium trifluoromethanesulfonate, or (p-tert-butylphenyl)diphenyl sulfonium trifluoromethanesulfonate; benzoin toluene sulfonate such as benzoin toluene sulfonate or a-methyl benzoin toluene sulfonate; other diphenyliodonium salt, triphenyl sulfonium salt, phenyl diazonium salt, or methyl phenyl carbonate.

The photoacid generator (C) can be used alone, and can also be used in a combination of 2 or more.

[0102] Moreover, based on a total amount of 100 parts by weight of the resin (A), the amount of the photoacid generator (C) is 0.5 parts by weight to 5 parts by weight, preferably 0.6 parts by weight to 4.5 parts by weight, and more preferably 0.7 parts by weight to 4 parts by weight.

Solvent (D)

[0103] The type of the solvent (D) is not particularly limited as long as the scope of the objects of the invention is not affected, and a suitable organic solvent commonly used in a positive photosensitive resin composition can be used.

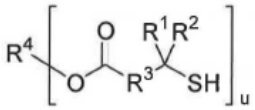
[0104] Specific examples of the solvent (D) can include, for instance, ketone such as

acetone, methyl ethyl ketone, cyclohexanone, methyl isopentyl ketone, or 2-heptanone; polyol and the derivative thereof such as monomethyl ether, monoethyl ether, monopropyl ether, monobutyl ether, or monophenyl ether of ethylene glycol, ethylene glycol monoacetate, diethylene glycol, diethylene glycol monoacetate, propylene glycol, propylene glycol monoacetate, dipropylene glycol, diethylene glycol dimethyl ether, and dipropylene glycol monoacetate; cyclic ether such as dioxane; ester such as ethyl formate, methyl lactate, ethyl lactate, methyl acetate, ethyl acetate, butyl acetate, methyl pyruvate, methyl acetoacetate, ethyl acetoacetate, ethyl pyruvate, ethyl ethoxyacetate, methyl methoxypropionate, ethyl ethoxypropionate, methyl 2-hydroxypropionate, ethyl 2-hydroxypropionate, ethyl 2-hydroxy-2-methylpropionate, methyl 2-hydroxy-3-methylbutanoate, 3-methoxybutyl acetate, or 3-methyl-3-methoxybutyl acetate; aromatic hydrocarbon such as toluene or xylene. These can be used alone and can also be used in a mixture of 2 or more.

[0105] Based on a total amount of 100 parts by weight of the resin (A), the amount of the solvent (D) is 30 parts by weight to 360 parts by weight, preferably 40 parts by weight to 300 parts by weight, and more preferably 50 parts by weight to 240 parts by weight.

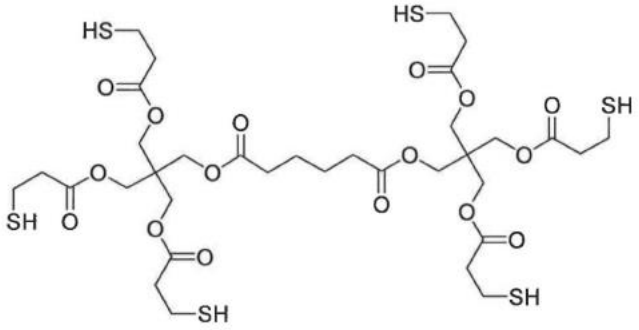
Thiol compound (E)

[0106] The thiol compound (E) has a structure represented by formula (E-l) below:

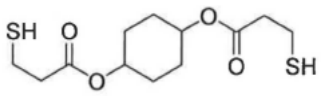


formula (E-1)

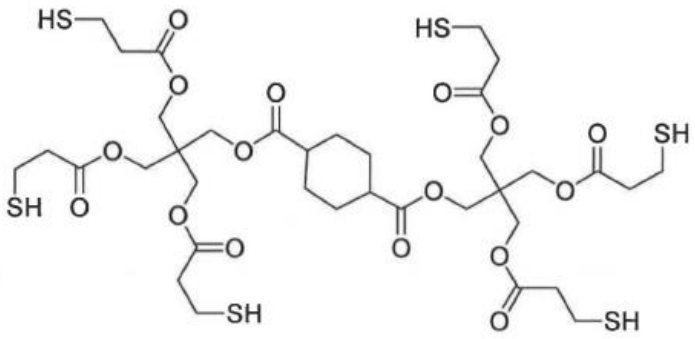
In formula (E-l), R^1 and R^2 each independently represent a hydrogen atom or



formula (E-14)



formula (E-15)



formula (E-16)

[0112] Based on a total amount of 100 parts by weight of the resin (A), the amount of the thiol compound (E) is 0.3 parts by weight to 3 parts by weight, preferably 0.4 parts by weight to 2.8 parts by weight, and more preferably 0.5 parts by weight to 2.5 parts by weight.

[0113] When the chemically-amplified positive photosensitive resin composition includes the thiol compound (E), the rectangularity of the chemically-amplified positive

photosensitive resin composition can be further improved.

Anthracene compound (F)

[0114] Specific examples of the anthracene compound (F) can include, but are not limited to, the following compounds: anthracene, 9,10-dibutoxyanthracene, 9,10-dimethoxyanthracene, 2-ethyl-9,10-dimethoxyanthracene, 2-tert-butyl-9,10-dimethoxyanthracene, 2,3-dimethyl-9,10-dimethoxyanthracene, 9-methoxy-10-methylanthracene, 9,10-diethoxyanthracene, 2-ethyl-9,10-diethoxyanthracene, 2-tert-butyl-9,10-diethoxyanthracene, 2,3 -dimethyl-9,10-diethoxyanthracene, 9-ethoxy-10-methylanthracene, 9,10-dipropoxyanthracene, 9,10-diisopropoxyanthracene, 2-ethyl-9,10-dipropoxyanthracene, 2-tert-butyl-9,10-dipropoxyanthracene, 2,3 -dimethyl-9,10-dipropoxyanthracene, 9-isopropoxy-10-methylanthracene, 9,10-dimethylphenoxyanthracene, 2-ethyl-9,10-dimethylphenoxyanthracene, 2-tert-butyl-9,10-dimethylphenoxyanthracene, 2,3-dimethyl-9,10-dimethylphenoxyanthracene, 9-tolyloxy-10-methylanthracene, 9,10-di-α -methyltoluoyloxyanthracene, 2-ethyl-9,10-di-α-methyltoluoyloxyanthracene, 2-tert-butyl-9,10-di-α-methyltoluoyloxyanthracene, 2,3-dimethyl-9,10-di-α-methyltoluoyloxyanthracene, 9-(α-methyltoluoxoxy)-10-methylanthracene, 9,10-diphenylanthracene, 9-methoxyanthracene, 9-ethoxyanthracene, 9-methylanthracene, 9-bromoanthracene, 9-methylthioanthracene, or 9-ethylthioanthracene.

[0115] Based on a total amount of 100 parts by weight of the resin (A), the amount of

the anthracene compound (F) is 0.2 parts by weight to 1.5 parts by weight, preferably 0.25 parts by weight to 1.3 parts by weight, and more preferably 0.3 parts by weight to 1.1 parts by weight. When the chemically-amplified positive photosensitive resin composition includes the anthracene compound (F), the sensitivity of the chemically-amplified positive photosensitive resin composition can be further improved.

Additive (G)

[0116] In the chemically-amplified positive photosensitive resin composition, an additive (G) can be further included as long as the effects of the invention are not affected, and the additive (G) can be used alone or in multiple combinations as decided based on actual need. The specific amount of the additive (G) is described below.

[0117] In the chemically-amplified positive photosensitive resin composition, to improve plasticity, a polyethylene resin can also be further included as the additive (G). Specific examples of the polyethylene resin can include, for instance, polyvinyl chloride, polystyrene, polyhydroxystyrene, polyvinyl acetate, polyvinyl benzoic acid, polyvinyl ether, polyethylene ether, polyvinyl alcohol, polyvinylpyrrolidone, polyphenol, and copolymers thereof. The polyethylene resin is preferably polyvinyl ether due to lower glass transition temperature.

[0118] Moreover, in the chemically-amplified positive photosensitive resin composition, to improve the bonding of the template formed by the photosensitive resin composition and the metal substrate, a bonding auxiliary can also be included as the additive (G). Specific examples of the bonding auxiliary can include products made by

CLAIMS

WHAT IS CLAIMED IS:

1. A chemically-amplified positive photosensitive resin composition, comprising:

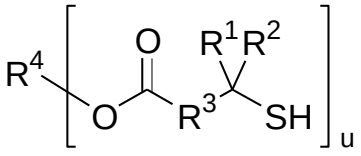
a resin (A), wherein the resin (A) is obtained by a copolymerization of a monomer mixture and contains an acid-dissociated protecting group;

a novolac resin (B) obtained by a polycondensation of a cresol aromatic hydroxyl compound and an aldehyde compound, and based on an integral area of 100% of a molecular weight of the novolac resin (B) measured by gel permeation chromatography, a cresol binuclear area of the novolac resin (B) is between 0.5% and 6%;

a photoacid generator (C); and

a solvent (D); and

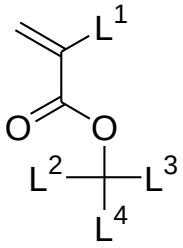
a thiol compound (E), wherein the thiol compound (E) has a structure represented by formula (E-1) below:



formula (E-1)

in formula (E-1), R^1 and R^2 each independently represent a hydrogen atom or a C_1 to C_4 alkyl group, R^3 represents a single bond or a C_1 to C_{10} alkylene group, and R^4 represents a u-valence organic group; and u represents an integer of 2 to 6.

2. The chemically-amplified positive photosensitive resin composition of claim 1, wherein the monomer mixture comprises a monomer (a1), and the monomer (a1) has a structure represented by formula (A-1) below:



formula (A-1)

in formula (A-1), L^1 represents a hydrogen atom, a C_1 to C_6 straight or branched alkyl group, a fluorine atom, or a C_1 to C_6 straight or branched fluorinated alkyl group; L^2, L^3, and L^4 respectively independently represent a C_1 to C_6 straight or branched alkyl group or a C_1 to C_6 straight or branched fluoroalkyl group, or L^3 and L^4 are bonded to each other to form a C_5 to C_{20} hydrocarbon ring.

3. The chemically-amplified positive photosensitive resin composition of claim 1, wherein the monomer mixture comprises a monomer (a2), and the monomer (a2) contains a cyclic ether group.

4. The chemically-amplified positive photosensitive resin composition of claim 1, further comprising an anthracene compound (F).

5. The chemically-amplified positive photosensitive resin composition of claim 1, wherein based on a total amount of 100 parts by weight of the resin (A), an amount of the novolac resin (B) is 20 parts by weight to 150 parts by weight, an amount of the photoacid generator (C) is 0.5 parts by weight to 5 parts by weight, and an amount of the solvent (D) is 30 parts by weight to 360 parts by weight.

6. The chemically-amplified positive photosensitive resin composition of claim 2, wherein based on a total amount of 100 parts by weight of the monomer mixture, an amount of the monomer (a1) is 10 parts by weight to 60 parts by weight.

7. The chemically-amplified positive photosensitive resin composition of claim 3, wherein based on a total amount of 100 parts by weight of the monomer mixture, an amount of the monomer (a2) is 5 parts by weight to 35 parts by weight.

8. The chemically-amplified positive photosensitive resin composition of claim 1, wherein based on a total amount of 100 parts by weight of the resin (A), an amount of the thiol compound (E) is 0.3 parts by weight to 3 parts by weight.

9. The chemically-amplified positive photosensitive resin composition of claim 4, wherein based on a total amount of 100 parts by weight of the resin (A), an amount of the anthracene compound (F) is 0.2 parts by weight to 1.5 parts by weight.

10. A manufacturing method of a substrate with a casting mold, comprising:

a laminate step, laminating a photosensitive resin layer formed by the chemically-amplified positive photosensitive resin composition of any of claims 1 to 9 on a metal surface of a substrate;

an exposure step, irradiating the photosensitive resin layer with an actinic ray or a radiation; and

a developing step, developing the photosensitive resin layer after exposure to form a casting mold for forming an electroplated molded article.

11. A manufacturing method of an electroplated molded article, comprising:

a step of electroplating the substrate with the casting mold made by the manufacturing method of the substrate with the casting mold of claim 10 to form an electroplated molded article in the casting mold.