CLAIMS

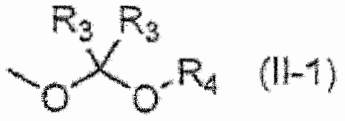
1. An actinic-ray- or radiation-sensitive resin composition comprising:

a resin containing a repeating unit containing a group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group; and

a compound that generates an acid of pKa≥-1.5 when exposed to actinic rays or radiation, wherein the acid generated by the compound is at least one member selected from the group consisting of a carboxylic acid, an imidic acid, and a methide acid.

2. An actinic-ray- or radiation-sensitive resin composition comprising:

a resin containing a repeating unit containing a group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group, wherein the resin contains no fluorine atom and no silicon atom, and the group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group is expressed by general formulae (II-1) below:



(II-1)

in which

each of R_3s independently, represents a hydrogen atom or a monovalent organic group, provided that two R_3s may be bonded to each other to thereby form a ring;

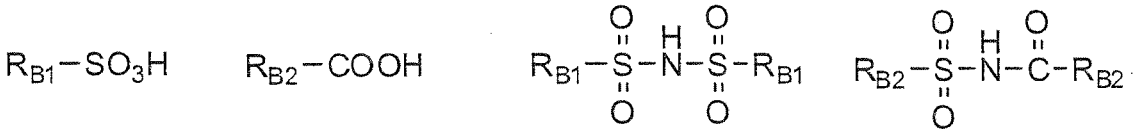
R_4 represents a monovalent organic group, provided that at least two

R_4s may be bonded to each other to thereby form a ring and that R_3 and R_4 may be bonded to each other to thereby form a ring.

3. An actinic-ray- or radiation-sensitive resin composition comprising:

a resin containing a repeating unit containing a group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group, wherein the resin contains no fluorine atom and no silicon atom, and the repeating unit contains no lactone structure; and

a compound that generates an acid of pKa≥-1.5 when exposed to actinic rays or radiation, which is expressed by any one of general formulae (B-4) to (B-7) below:



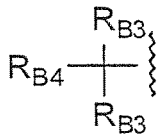
(B-4) (B-5) (B-6) (B-7)

in the general formulae (B-4) to (B-7),

$R_{B1'}$, or each of $R_{B1'}$s independently, represents a cycloalkyl group, OR_{B2}, $N(R_{B2})_2$, an aryl group,

R_{B1}, or each of R_{B1}s independently, represents a cycloalkyl group, OR_{B2}, $N(R_{B2})_2$, an aryl group, or any of the groups of general formula (B-8) below, wherein two R_{B1}s may be bonded to each other to thereby form a ring;

R_{B2}, or each of R_{B2}s independently, represents a monovalent organic group, wherein two or more R_{B2}s exist in a single molecule, at least two thereof may be bonded to each other to thereby form a ring,



(B-8)

in the general formula (B-8),

each of R_{B3}s independently represents a hydrogen atom, $C(R_{B4})_3$, $N(R_{B4})_2$, OR_{B4}, SR_{B4}, $C(R_{B4})=C(R_{B4})_2$, $C\equiv CR_{B4}$, $C(=NR_{B4})R_{B4}$, $C(=O)R_{B4}$, $C(=S)R_{B4}$, $C\equiv N$, NO_2, NO, NCO or $N=C(R_{B4})_2$, wherein two or more R_{B3}s exist in a single molecule, at least two thereof may be bonded to each other to thereby form a ring, and

R_{B4} represents a monovalent organic group, wherein two or more R_{B4}s exist in a single molecule, at least two thereof may be bonded to each other to thereby form a ring.

4. A method of forming a pattern, comprising:

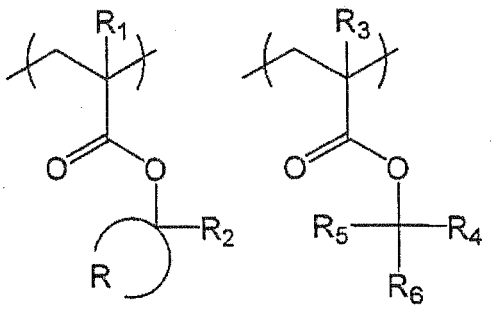
(A) forming a film from an actinic-ray- or radiation-sensitive resin composition comprising a resin containing a repeating unit containing an acid-decomposable group, and a compound that generates an acid of pKa≥-1.5 when exposed to actinic-rays or radiation;

(B) exposing the film to light; and

(C) developing the exposed film using a developer containing an organic solvent,

wherein the resin contains, as the repeating unit containing an acid-decomposable group, only a repeating unit having a group that is decomposed when acted upon by an acid to thereby produce an alcoholic hydroxyl group containing no lactone structure, and a

repeating unit of general formula (I) or (II) below.



(I) (II)

In general formulae (I) and (II),

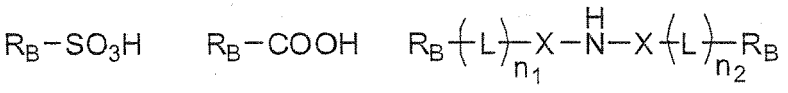
each of R_1 and R_3 independently represents a hydrogen atom, an optionally substituted methyl group or any of the groups of the formula $-CH_2-R_9$, wherein R_9 represents a monovalent organic group.

each of R_2, R_4, R_5 and R_6 independently represents an alkyl group or a cycloalkyl group, and

R represents an atomic group required for forming an alicyclic structure in cooperation with a carbon atom.

5. The composition according to claim 2, wherein the acid generated by the compound is at least one member selected from the group consisting of a sulfonic acid, a carboxylic acid, an imidic acid, and a methide acid.

6. The composition according to claim 2, wherein the acid generated by the compound is expressed by any one of general formulae (B-1) to (B-3) below:



(B-1) (B-2) (B-3)

in which

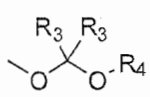
R_B, or each of R_Bs independently, represents a monovalent organic group, provided that in general formula (B-3), two R_Bs may be bonded to each other to thereby form a ring;

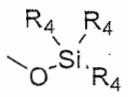
each of X's independently represents -CO-, -SO_2- or -SO-;

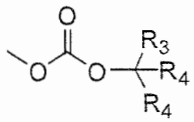
L, or each of L's independently, represents a bivalent connecting group; and

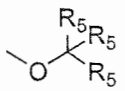
each of n_1 and n_2 independently is 0 or 1.

7. The composition according to claim 1, wherein the group that is decomposed when acted upon by an acid to thereby produce an alcoholic hydroxyl group is expressed by at least one selected from the group consisting of general formulae (II-1) to (II-4) below:


(II-1)


(II-2)


(II-3)


(II-4)

in which

R_3, or each of R_3s independently, represents a hydrogen atom or a monovalent organic group, provided that two R_3s may be bonded to each other to thereby form a ring;

R_4, or each of R_4s independently, represents a monovalent organic group, provided that at least two R_4s may be bonded to each other to thereby form a ring and that R_3 and R_4 may be bonded to each other to thereby form a ring; and

each of R_5s independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, an alkenyl group or an alkynyl group, provided that at least two R_5s may be bonded to each other to thereby form a ring and that, when one or two of three R_5s are a hydrogen atom, at least one of the rest of R_5s represents an aryl group, an alkenyl group or an alkynyl

group.

8. The composition according to any one of claims 1 to 3 and 5 to 7, wherein the repeating unit is contained in an amount of 70 to 100 mol% based on the total amount of repeating units containing an acid-decomposable group contained in the resin.

9. The composition according to any one of claims 1 to 3 and 5 to 8, further comprising a hydrophobic resin.

10. The composition according to claim 9, wherein the hydrophobic resin composition is a resin containing at least one of fluorine atom and silicon atom.

11. A resist pattern formed from the composition according to any one of claims 1 to 3 and 5 to 10.

12. A method of forming a pattern, comprising:

(A) forming a film from the composition of any one of claims 1 to 3 and 5 to 7;

(B) exposing the film to light;

(C) developing the exposed film.

13. The method according to claim 12, wherein the developing uses a developer containing an organic solvent.

14. The method according to claim 4 or 13, wherein the developer contains at least an ester solvent as the organic solvent.

C L A I M S

1. A method of forming a pattern, comprising:

(A) forming a film from an actinic-ray- or radiation-sensitive resin composition comprising:

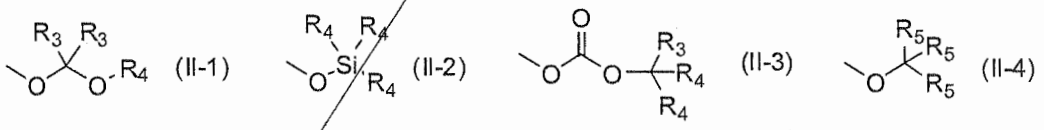
a resin containing a repeating unit containing a group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group; and

a compound that generates an acid of pKa≥-1.5 when exposed to actinic rays or radiation,

(B) exposing the film to light, and

(C) developing the exposed film using a developer containing an organic solvent,

wherein the group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group is expressed by at least one selected from the group consisting of general formulae (II-1) to (II-4) below:



in which

R_3, or each of R_3s independently, represents a hydrogen atom or a monovalent organic group, provided that two R_3s may be bonded to each other to thereby form a ring;

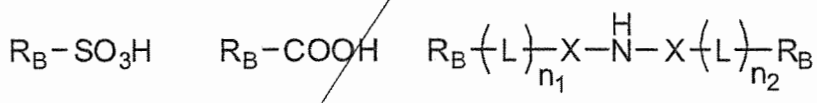
R_4, or each of R_4s independently, represents a monovalent organic group, provided that at least two R_4s may be bonded to each other to thereby form a ring and that R_3 and R_4 may be bonded to each other to thereby form a ring; and

each of R_5s independently represents a hydrogen atom,

an alkyl group, a cycloalkyl group, an aryl group, an alkenyl group or an alkynyl group, provided that at least two R_5s may be bonded to each other to thereby form a ring and that when one or two of three R_5s are a hydrogen atom, at least one of the rest of R_5s represents an aryl group, an alkenyl group or an alkynyl group.

2. The method according to claim 1, wherein the acid generated by the compound is at least one member selected from the group consisting of a sulfonic acid, a carboxylic acid, an imidic acid, and a methide acid.

3. The method according to claim 1 or 2, wherein the acid generated by the compound is expressed by any one of general formulae (B-1) to (B-3) below:



(B-1) (B-2) (B-3)

in which

R_B, or each of R_Bs independently, represents a monovalent organic group, provided that in general formula (B-3), two R_Bs may be bonded to each other to thereby form a ring;

each of X's independently represents -CO-, $-SO_2-$ or -SO-;

L, or each of L's independently, represents a

bivalent connecting group; and

each of n_1 and n_2 independently is 0 or 1.

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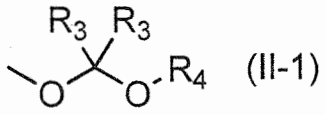
4. The method according to any of claims 1 to 3, wherein the group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group is expressed by general formula (II-1) below:



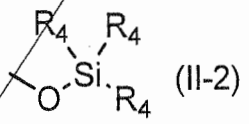
(II-1)

in which

each of R_3s independently represents a hydrogen atom or a monovalent organic group, provided that two R_3s may be bonded to each other to thereby form a ring; and

R_4 represents a monovalent organic group, provided that R_3 and R_4 may be bonded to each other to thereby form a ring.

5. The method according to any of claims 1 to 3, wherein the group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group is expressed by general formula (II-2) below):



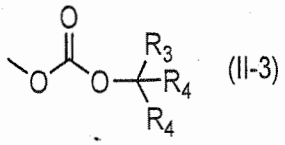
(II-2)

in which

each of R_4s independently represents a monovalent organic group, provided that at least two R_4s may be bonded to each other to thereby form a ring.

6. The method according to any of claims 1 to 3, wherein the group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group is

expressed by general formula (II-3) below:

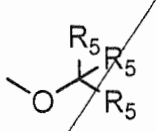


(II-3)

in which R_3 represents a hydrogen atom or a monovalent organic group; and

each of R_4s independently represents a monovalent organic group, provided that two R_4s may be bonded to each other to thereby form a ring and that R_3 and R_4 may be bonded to each other to thereby form a ring.

7. The method according to any of claims 1 to 3, wherein the group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group is expressed by general formula (II-4) below:



(II-4)

in which

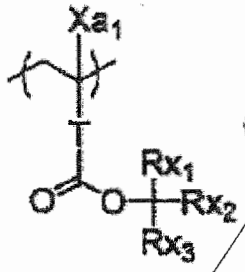
each of R_5s independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, an alkenyl group or an alkynyl group, provided that at least two R_5s may be bonded to each other to thereby form a ring and that when one or two of three R_5s are a hydrogen atom, at least one of the rest of R_5s represents an aryl group, an alkenyl group or an alkynyl group.

8. The method according to any of claims 1 to 7, wherein the repeating unit is contained in an amount of 70 to 100 mol% based on the total amount of

repeating units containing an acid-decomposable group contained in the resin.

9. The method according to any of claims 1 to 8, wherein the resin further contains a repeating unit containing a group that is decomposed when acted on by an acid to thereby produce a polar group other that the alcoholic hydroxyl group.

10. The method according to claim 9, wherein the repeating unit containing a group that is decomposed when acted on by an acid to thereby produce a polar group other than the alcoholic hydroxyl group, is any of those of general formula (AI) below:



(A I)

in general formula (AI),

Xa_1 represents a hydrogen atom, an optionally substituted methyl group, or a group reperesented by $-CH_2-R_9$, in which R_9 represents a hydroxyl group or a monovalent organic group,

T represent a single bond or a bivalent connecting group,

Each of Rx_1 to Rx_3 independently represents alinear or branched alkyl group or a mono- or polycycloalkyl group, at leat two of Rx_1 to Rx_3 may be bonded to each other to thereby form a mono- or polycycloalkyl group.

11. The method according to any of claims 1 to 10, wherein the actinic-ray- or radiation-sensitive resin composition further comprises a hydrophobic resin.

12. The method according to claim 11, wherein the hydrophobic resin is a resin containing at least one of fluorine atom and silicon atom.

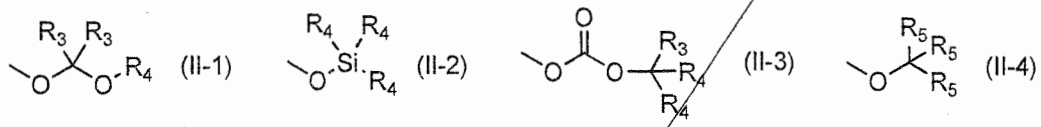
13. The method according to any of claims 1 to 12, wherein a pattern formed by the developing is a negative pattern.

14. The method according to any of claims 1 to 13, wherein an amount of the organic solvent used in the developer is in the range of 95 to 100 mass% based on the whole amount of the developer.

15. A resist pattern formed from the method of any of claims 1 to 14.

16. An actinic-ray- or radiation-sensitive resin composition, comprising a resin containing a repeating unit containing a group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group,

and a compound that generates an acid of pKa≥-1.5 when exposed to actinic rays or radiation, wherein the group that is decomposed when acted on by an acid to thereby produce an alcoholic hydroxyl group is expressed by at least one selected from the group consisting of general formulae (II-1) to (II-4) below:



in which

R_3, or each of R_3s independently, represents a hydrogen atom or a monovalent organic group, provided that two R_3s may be bonded to each other to thereby form a ring;

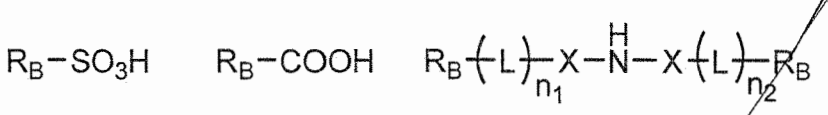
R_4, or each of R_4s independently, represents a monovalent organic group, provided that at least two R_4s may be bonded to each other to thereby form a ring and that R_3 and R_4 may be bonded to each other to thereby form a ring; and

each of R_5s independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group, an alkenyl group or an alkynyl group, provided that at least two R_5s may be bonded to each other to thereby form a ring and that when one or two of three R_5s are a hydrogen atom, at least one of the rest of R_5s represents an aryl group, an alkenyl group or an alkynyl group.

17. The composition according to claim 16, wherein the acid generated by the compound is at least one member selected from the group consisting of a sulfonic acid, a

carboxylic acid, an imidic acid, and a methide acid.

18. The composition according to claim 16 or 17, wherein the acid generated by the compound is expressed by any one of general formulae (B-1) to (B-3) below:



(B-1) (B-2) (B-3)

in which

R_B, or each of R_Bs independently, represents a monovalent organic group, provided that in general formula (B-3), two R_Bs may be bonded to each other to thereby form a ring;

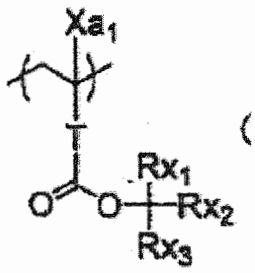
each of X's independently represents -CO-, -SO_2- or -SO-;

L, or each of L's independently, represents a bivalent connecting group; and

Each of n_1 and n_2 independently is 0 or 1.

19. The composition according to any of claims 16 to 18, wherein the resin further contains a repeating unit containing a group that is decomposed when acted on by an acid to thereby produce a polar group other that the alcoholic hydroxyl group.

20. The composition according to claim 19, wherein the repeating unit containing a group that is decomposed when acted on by an acid to thereby produce a polar group other than the alcoholic hydroxyl group, is any of those of general formula (AI) below:



(A I)

in general formula (AI),

Xa_1 represents a hydrogen atom, an optionally substituted methyl group, or a group reperesented by $-CH_2-R_9$, in which R_9 represents a hydroxyl group or a monovalent organic group,

T represent a single bond or a bivalent connecting group,

Each of Rx_1 to Rx_3 independently represents alinear or branched alkyl group or a mono- or polycycloalkyl group, at leat two of Rx_1 to Rx_3 may be bonded to each other to thereby form a mono- or polycycloalkyl group.

21. The composition according to any of claims 16 to 20, further comprising a hydrophobic resin.

22. The composition according to claim 21, wherein the hydrophobic resin composition is a resin containing at least one of fluorine atom and silicon atom.

23. A method of manufacturing a semiconductor device, comprising the method of forming a pattern according to any of claims 1 to 14.

24. A semiconductor device manufactured by the method according to claim 23.