Claims

1. A pattern forming method comprising:

(i) a step of forming a film from an actinic ray-sensitive or radiation-sensitive resin composition,

(ii) a step of exposing the film, and

(iii) a step of developing the exposed film by using an organic solvent-containing developer,

wherein the actinic ray-sensitive or radiation-sensitive resin composition comprises:

(A) a resin capable of decreasing the solubility for an organic solvent-containing developer by the action of an acid,

(B) a compound capable of generating an acid upon irradiation with an actinic ray or radiation,

(D) a solvent, and

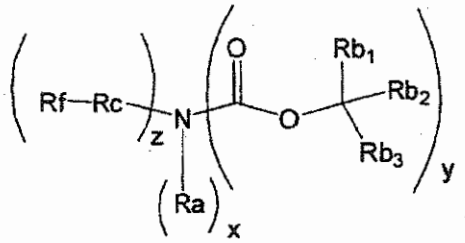
(G) a compound having at least either one of a fluorine atom and a silicon atom and having basicity or being capable of increasing the basicity by the action of an acid.

2. The pattern forming method according to claim 1, wherein the resin (A) contains a first repeating unit having a group capable of decomposing by the action of an acid to produce an alcoholic hydroxy group.

3. The pattern forming method according to claim 1 or 2, wherein the compound (G) is a nitrogen-containing compound.

4. The pattern forming method according to any one of claims 1 to 3, wherein the compound (G) has a molecular weight of 500 or less.

5. The pattern forming method according to claim 3 or 4, wherein the compound (G) is a compound represented by the following formula (1):



(1)

wherein, each of Ra, Rb_1, Rb_2 and Rb_3 independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group or an aralkyl group, and two members out of Rb_1 to Rb_3 may combine with each other to form a ring, provided that all of Rb_1 to Rb_3 are not a hydrogen atom at the same time,

Rc represents a single bond or a divalent linking group,

Rf represents an organic group,

x represents 0 or 1, y represents 1 or 2, z represents 1 or 2, and x+y+z=3,

when x=z=1, Ra and Rc may combine with each other to form a nitrogen-containing heterocyclic ring,

when z=1, the organic group as Rf contains a fluorine atom or a silicon atom,

when z=2, at least either one of two Rf's contains a fluorine atom or a silicon atom,

when z=2, two Rc's may be the same or different, two Rf's may be the same or different, and two Rc's may combine with each other to form a ring,

when y=2, two Rb_1's may be the same or different, two Rb_2's may be the same or different, and two Rb_3's may be the same or different.

6. The pattern forming method according to any one of claims 1 to 3, wherein the compound (G) is a resin.

7. The pattern forming method according to claim 6, wherein the resin (G) contains a repeating unit having at least either one of a fluorine atom and a silicon atom and a repeating unit having a basic group or a group capable of increasing the basicity by the action of an acid.

8. The pattern forming method according to any one of claims 1 to 7, wherein the composition further contains a crosslinking agent (C).

9. The pattern forming method according to any one of claims 1 to 8, whwerein

the developer contains at least one kind of an organic solvent selected from a ketone-based solvent, an ester-based solvent, an alcohol-based solvent, an amide-based solvent and an ether-based solvent.

10. The pattern forming method according to any one of claims 1 to 9, which further comprises (iv) a step of rinsing the film with a rinsing solution.

11. The pattern formig method according to claim 10, wherein the the rinsing solution is preferably a rinsing solution containing at least one kind of an organic solvent selected from a hydrocarbon-based solvent, a ketone-based solvent, an ester-based solvent, an alcohol-based solvent, an amide-based solvent and an ether-based solvent.

12. The pattern forming method according to any one of claims 1 to 11, wherein an exposure in the step of exposing the film is an immersion exposure.

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

(A) a resin capable of decreasing the solubility for an organic solvent-containing developer by the action of an acid,

(B) a compound capable of generating an acid upon irradiation with an actinic ray or radiation,

(D) a solvent, and

(G) a compound having at least either one of a fluorine atom and a silicon atom and having basicity or being capable of increasing the basicity by the action of an acid.

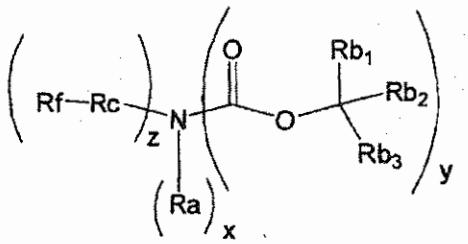
14. The actinic ray-sensitive or radiation-sensitive resin composition according to claim 13, wherein the resin (A) contains a first repeating unit having a group capable of decomposing by the action of an acid to produce an alcoholic hydroxy group.

15. The actinic ray-sensitive or radiation-sensitive resin composition according to claim 13 or 14, wherein the compound (G) is a nitrogen-containing compound.

16. The actinic ray-sensitive or radiation-sensitive resin composition according to any one of claims 13 to 15, wherein the compound (G) has a molecular weight of

500 or less.

17. The actinic ray-sensitive or radiation-sensitive resin composition according to claim 15 or 16, wherein the compound (G) is a compound represented by the following formula (1):



(1)

wherein, each of Ra, Rb_1, Rb_2 and Rb_3 independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group or an aralkyl group, and two members out of Rb_1 to Rb_3 may combine with each other to form a ring, provided that all of Rb_1 to Rb_3 are not a hydrogen atom at the same time,

Rc represents a single bond or a divalent linking group,

Rf represents an organic group,

x represents 0 or 1, y represents 1 or 2, z represents 1 or 2, and x+y+z=3,

when x=z=1, Ra and Rc may combine with each other to form a nitrogen-containing heterocyclic ring,

when z=1, the organic group as Rf contains a fluorine atom or a silicon atom,

when z=2, at least either one of two Rf's contains a fluorine atom or a silicon atom,

when z=2, two Rc's may be the same or different, two Rf's may be the same or different, and two Rc's may combine with each other to form a ring,

when y=2, two Rb_1's may be the same or different, two Rb_2's may be the same or different, and two Rb_3's may be the same or different.

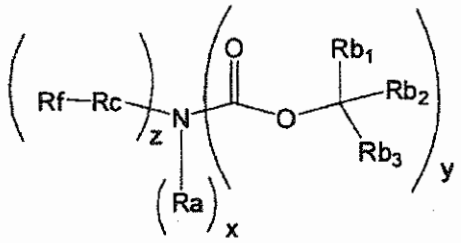
18. The actinic ray-sensitive or radiation-sensitive resin composition according to any one of claims 13 to 15, wherein the compound (G) is a resin.

19. The actinic ray-sensitive or radiation-sensitive resin composition according to claim 18, wherein the resin (G) contains a repeating unit having at least either one of a fluorine atom and a silicon atom and a repeating unit having a basic group or a group capable of increasing the basicity by the action of an acid.

20. The actinic ray-sensitive or radiation-sensitive resin composition according to any one of claims 13 to 19, wherein the composition further contains a crosslinking agent (C).

21. A resist film formed by the composition according to any one of claims 13 to 20.

22. A compound represented by the following formula (1):



(1)

wherein, each of Ra, Rb_1, Rb_2 and Rb_3 independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group or an aralkyl group, and two members out of Rb_1 to Rb_3 may combine with each other to form a ring, provided that all of Rb_1 to Rb_3 are not a hydrogen atom at the same time,

Rc represents a single bond or a divalent linking group,

Rf represents an organic group,

x represents 0 or 1, y represents 1 or 2, z represents 1 or 2, and x+y+z=3,

when x=z=1, Ra and Rc may combine with each other to form a nitrogen-containing heterocyclic ring,

when z=1, the organic group as Rf contains a fluorine atom or a silicon atom,

when z=2, at least either one of two Rf's contains a fluorine atom or a silicon atom,

when z=2, two Rc's may be the same or different, two Rf's may be the same or different, and two Rc's may combine with each other to form a ring,

when y=2, two Rb_1's may be the same or different, two Rb_2's may be the same or different, and two Rb_3's may be the same or different.

23. A resin (G) having at least either one of a fluorine atom and a silicon atom, and having a basic group or a group capable of increasing the basicity by the action of an acid.

Claims

1. A pattern forming method comprising:

(i) a step of forming a film from a chemical amplification-type resist composition,

(ii) a step of exposing the film, and

(iii) a step of developing the exposed film by using an organic solvent-containing developer,

wherein the resist composition comprises:

(A) a resin capable of decreasing the solubility for an organic solvent-containing developer by the action of an acid,

(B) a compound capable of generating an acid upon irradiation with an actinic ray or radiation,

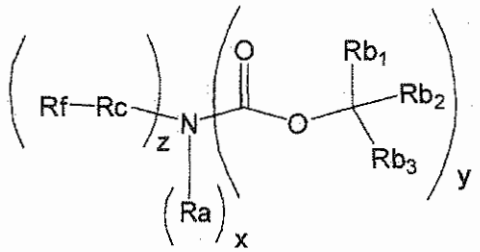
(D) a solvent, and

(G) a compound having at least either one of a fluorine atom and a silicon atom and having basicity or being capable of increasing the basicity by the action of an acid.

2. The pattern forming method according to claim 1, wherein the compound (G) is a nitrogen-containing compound.

3. The pattern forming method according to claim 1 or 2, wherein the compound (G) has a molecular weight of 500 or less.

4. The pattern forming method according to claim 2 or 3, wherein the compound (G) is a compound represented by the following formula (1):



(1)

wherein, in formula (1),

each of Ra, Rb_1, Rb_2 and Rb_3 independently represents a hydrogen atom, an

alkyl group, a cycloalkyl group, an aryl group or an aralkyl group, and two members out of Rb_1 to Rb_3 may combine with each other to form a ring, provided that all of Rb_1 to Rb_3 are not a hydrogen atom at the same time,

Rc represents a single bond or a divalent linking group,

Rf represents an organic group,

x represents 0 or 1, y represents 1 or 2, z represents 1 or 2, and x+y+z=3,

when x=z=1, Ra and Rc may combine with each other to form a nitrogen-containing heterocyclic ring,

when z=1, the organic group as Rf contains a fluorine atom or a silicon atom,

when z=2, at least either one of two Rf's contains a fluorine atom or a silicon atom,

when z=2, two Rc's may be the same or different, two Rf's may be the same or different, and two Rc's may combine with each other to form a ring,

when y=2, two Rb_1's may be the same or different, two Rb_2's may be the same or different, and two Rb_3's may be the same or different.

5. The pattern forming method according to claim 1 or 2, wherein the compound (G) is a resin.

6. The pattern forming method according to claim 5, wherein the compound (G) is a resin containing a repeating unit having at least either one of a fluorine atom and a silicon atom and a repeating unit having a basic group or a group capable of increasing the basicity by the action of an acid.

7. The pattern forming method according to any one of claims 1 to 6, wherein the resist composition further contains a crosslinking agent (C).

8. The pattern forming method according to any one of claims 1 to 7, wherein the developer contains at least one kind of an organic solvent selected from a ketone-based solvent, an ester-based solvent, an alcohol-based solvent, an amide-based solvent and an ether-based solvent.

9. The pattern forming method according to any one of claims 1 to 8, which further comprises (iv) a step of rinsing the film with a rinsing solution.

10. The pattern formig method according to claim 9, wherein the the rinsing solution is a rinsing solution containing at least one kind of an organic solvent selected from a hydrocarbon-based solvent, a ketone-based solvent, an ester-based solvent, an alcohol-based solvent, an amide-based solvent and an ether-based solvent.

11. The pattern forming method according to any one of claims 1 to 10, wherein an exposure in the step of exposing the film is an immersion exposure.

12. A chemical amplification-type resist composition comprising:

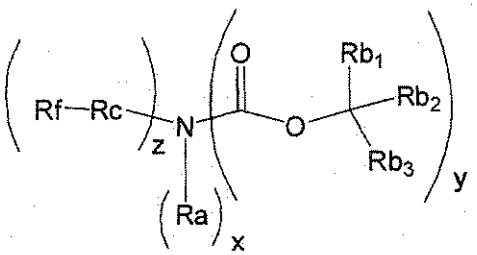
(A) a resin capable of decreasing the solubility for an organic solvent-containing developer by the action of an acid,

(B) a compound capable of generating an acid upon irradiation with an actinic ray or radiation,

(D) a solvent, and

(G) a compound having at least either one of a fluorine atom and a silicon atom and having basicity or being capable of increasing the basicity by the action of an acid,

wherein the compound (G) is a compound represented by the following formula (1):



(1)

wherein, in formula (1),

each of Ra, Rb_1, Rb_2 and Rb_3 independently represents a hydrogen atom, an alkyl group, a cycloalkyl group, an aryl group or an aralkyl group, and two members out of Rb_1 to Rb_3 may combine with each other to form a ring, provided that all of Rb_1 to Rb_3 are not a hydrogen atom at the same time,

Rc represents a single bond or a divalent linking group,

Rf represents an organic group,

x represents 0 or 1, y represents 1 or 2, z represents 1 or 2, and x+y+z=3,

when x=z=1, Ra and Rc may combine with each other to form a nitrogen-containing heterocyclic ring,

when z=1, the organic group as Rf contains a fluorine atom or a silicon atom,

when z=2, at least either one of two Rf's contains a fluorine atom or a silicon atom,

when z=2, two Rc's may be the same or different, two Rf's may be the same or different, and two Rc's may combine with each other to form a ring,

when y=2, two Rb_1's may be the same or different, two Rb_2's may be the same or different, and two Rb_3's may be the same or different.

13. A chemical amplification-type resist composition comprising:

(A) a resin capable of decreasing the solubility for an organic solvent-containing developer by the action of an acid,

(B) a compound capable of generating an acid upon irradiation with an actinic ray or radiation,

(D) a solvent, and

(G) a compound having at least either one of a fluorine atom and a silicon atom and having basicity or being capable of increasing the basicity by the action of an acid,

a hydrophobic resin having a fluorine atom, not corresponding to the compound (G).

14. The chemical amplification-type resist composition according to claim 12 or 13, wherein the compound (G) has a molecular weight of 500 or less.

15. A chemical amplification-type resist composition comprising:

(A) a resin capable of decreasing the solubility for an organic solvent-containing developer by the action of an acid,

(B) a compound capable of generating an acid upon irradiation with an actinic ray or radiation,

(D) a solvent, and

(G-2) a compound having at least either one of a fluorine atom and a silicon atom and being capable of increasing the basicity by the action of an acid,

wherein the compound (G-2) is a resin.

16. The chemical amplification-type resist composition according to claim 15, wherein the compound (G-2) is a resin containing a repeating unit having at least either

one of a fluorine atom and a silicon atom and a repeating unit having a group capable of increasing the basicity by the action of an acid.

17. The chemical amplification-type resist composition according to any one of claims 12, 15 and 16, further containing:

a hydrophobic resin having at least either one of a fluorine atom and a silicon atom, not corresponding to the component (G) or (G-2).

18. The chemical amplification-type resist composition according to any one of claims 12 to 17, further containing a crosslinking agent (C).

19. A resist film formed by the chemical amplification-type resist composition according to any one of claims 12 to 18.