CLAIMS

1. A positive photosensitive resin composition comprising

(A) an alkali-soluble resin,

(B) a diazoquinone compound,

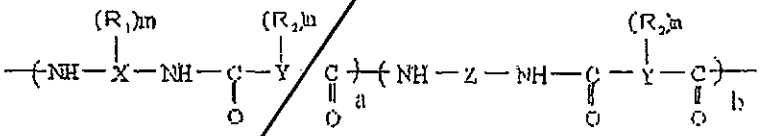
(d1) an activated silicon compound, and

(d2) an aluminum complex.

2. The positive photosensitive resin composition as claimed in Claim 1, wherein said (d1) activated silicon compound is a compound having an alkoxysilane bond.

3. The positive photosensitive resin composition as claimed in Claim 1 or 2, wherein said (A) alkali-soluble resin is a resin comprising a polybenzoxazole structure, a polybenzoxazole precursor structure, a polyimide structure, a polyimide precursor structure or a polyamide acid ester structure.

4. The positive photosensitive resin composition as claimed in any of Claims 1 to 3, wherein said (A) alkali-soluble resin is a resin represented by general formula (1):



(1)

wherein X and Y are an organic group; a and b represent a molar percentage, a + b = 100, a is 60 or more and 100 or less and b is 0 or more and 40 or less; R_1 is a hydroxy group or $-O-R_3$, which may be the same or different; R_2 is a hydroxy group, a carboxyl group, $-O-R_3$ or $-COO-R_3$, which may be the same or different; m is a positive number

of 0 to 2; n is a positive number of 0 to 4; R_3 is an organic group having 1 to 15 carbon atoms, where when R_1s are not a hydroxy group, at least one of R_2s must be a carboxyl group and where when R_2s are not a carboxyl group, at least one of R_1s must be a hydroxy group; Z is represented by $-R_4-Si(R_6)(R_7)-O-Si(R_6)(R_7)-R_5-$ where R_4 to R_7 are an organic group.

5. A patterning process comprising

applying the positive photosensitive resin composition as claimed in any of Claims 1 to 4 on a substrate to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam and then

heating said resin layer.

6. A semiconductor device comprising

a semiconductor substrate,

a semiconductor chip formed on or over said semiconductor substrate,

a protective layer or insulating layer formed over said semiconductor chip,

wherein said protective layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive resin composition as claimed in any of Claims 1 to 4.

7. A display comprising a substrate for a display device, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display device,

wherein said flattened layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive

resin composition as claimed in any of Claims 1 to 4.

8. A process for manufacturing a semiconductor device comprising a semiconductor chip and a protective layer or insulating layer formed over said semiconductor chip, comprising

applying a positive photosensitive resin composition on said semiconductor chip and drying said composition to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said protective layer or insulating layer,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in any of Claims 1 to 4.

9. A process for manufacturing a display comprising a substrate, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display device, comprising

applying a positive photosensitive resin composition on said substrate to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said flattened layer or insulating layer,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in any of Claims 1 to 4.

10. A positive photosensitive resin composition comprising

(A) an alkali-soluble resin,

(B) a diazoquinone compound,

(C) a compound having two or more oxetanyl groups in one molecule, and

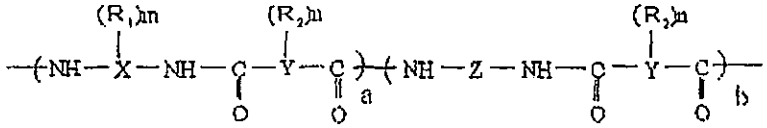
(D) a catalyst for accelerating the ring-opening reaction of said oxetanyl groups of compound (C).

11. The positive photosensitive resin composition as claimed in Claim 10, wherein said (D) component is at least one selected from an onium salt, a sulfone compound or the combinations of an activated silicon compound with an aluminum complex.

12. The positive photosensitive resin composition as claimed in Claim 10, wherein said (D) component comprises an aluminum complex and an activated silicon compound.

13. The positive photosensitive resin composition as claimed in any of Claims 10 to 12, wherein said (A) alkali-soluble resin is a resin comprising a polybenzoxazole structure, a polybenzoxazole precursor structure, a polyimide structure, a polyimide precursor structure or a polyamide acid ester structure.

14. The positive photosensitive resin composition as claimed in any of Claims 10 to 13, wherein said (A) alkali-soluble resin is a resin represented by general formula (1):



(I)

wherein X and Y are an organic group; a and b represent a molar percentage, a + b = 100, a is 60 or more and 100 or less and b is 0 or more and 40 or less; R_1 is a hydroxy group or $-O-R_3$, which may be the same or different; R_2 is a hydroxy group, a carboxyl group, $-O-R_3$ or $-COO-R_3$, which may be the same or different; m is a positive number of 0 to 2; n is a positive number of 0 to 4; R_3 is an organic group having 1 to 15 carbon atoms, where when R_1s are not a hydroxy group, at least one of R_2s must be a carboxyl group and where when R_2s are not a carboxyl group, at least one of R_1s must be a hydroxy group; Z is represented by $-R_4-Si(R_6)(R_7)-O-Si(R_6)(R_7)-R_5-$ where R_4 to R_7 are an organic group.

15. A patterning process comprising

applying the positive photosensitive resin composition as claimed in any of Claims 10 to 14 on a substrate to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam and then

heating said resin layer.

16. A semiconductor device, comprising

a semiconductor substrate,

a semiconductor chip formed on or over said semiconductor substrate,

a protective layer or insulating layer formed over said

semiconductor chip,

wherein said protective layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive resin composition as claimed in any of Claims 10 to 14.

17. A display comprising a substrate for a display device, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display device,

wherein said flattened layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive resin composition as claimed in any of Claims 10 to 14.

18. A process for manufacturing a semiconductor device comprising a semiconductor chip and a protective layer or insulating layer formed over said semiconductor chip, comprising

applying a positive photosensitive resin composition on said semiconductor chip and drying said composition to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said protective layer or insulating layer,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in any of Claims 10 to 14.

19. A process for manufacturing a display comprising a substrate, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display

device, comprising

applying a positive photosensitive resin composition on said substrate and drying the composition to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said flattened layer or insulating layer,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in any of Claims 10 to 14.

CLAIMS

1. A positive photosensitive resin composition comprising

(A) an alkali-soluble resin,

(B) a diazoquinone compound,

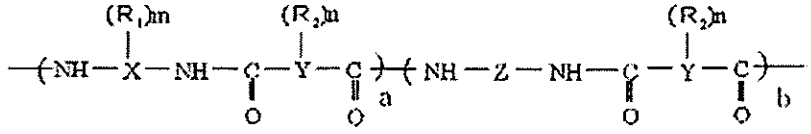
(d1) an activated silicon compound having an Si-O-C bond, and

(d2) an aluminum complex.

2. The positive photosensitive resin composition as claimed in Claim 1, wherein said (d1) activated silicon compound is a compound having an alkoxysilane bond.

3. The positive photosensitive resin composition as claimed in Claim 1, wherein said (A) alkali-soluble resin is a resin comprising a polybenzoxazole structure, a polybenzoxazole precursor structure, a polyimide structure, a polyimide precursor structure or a polyamide acid ester structure.

4. The positive photosensitive resin composition as claimed in Claim 1, wherein said (A) alkali-soluble resin is a resin represented by general formula (1):



(1)

wherein X and Y are an organic group; a and b represent a molar percentage, a + b = 100, a is 60 or more and 100 or less and b is 0 or more and 40 or less; R_1 is a hydroxy group or -O-R_3, which may be the same or different; R_2 is a hydroxy group, a carboxyl group, -O-R_3 or -COO-R_3, which may be the same or different; m is a positive number of 0 to 2; n is a positive number of 0 to 4; R_3 is an organic group having 1 to 15 carbon atoms, where when R_1s are not a hydroxy group, at least one of R_2s must be a carboxyl group and where when R_2s are not a carboxyl group, at least one of R_1s must

be a hydroxy group; Z is represented by $-R_4-Si(R_6)(R_7)-O-Si(R_6)(R_7)-R_5-$ where R_4 to R_7 are an organic group.

5. A patterning process comprising

applying the positive photosensitive resin composition as claimed in Claim 1 on a substrate to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam and then

heating said resin layer, wherin the heating step causes the activated silicon compound to generate a silanol group which reacts with the aluminum complex compound to generate a Broensted acid which catalyzes the cyclization of the alkali-soluble resin.

6. A semiconductor device, comprising

a semiconductor substrate,

a semiconductor chip formed on or over said semiconductor substrate,

a protective layer or insulating layer formed over said semiconductor chip,

wherein said protective layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive resin composition as claimed in Claim 1.

7. A display comprising a substrate for a display device, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display device,

wherein said flattened layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive resin composition as claimed in Claim 1.

8. A process for manufacturing a semiconductor device comprising a semiconductor chip and a protective layer or insulating

layer formed over said semiconductor chip, comprising

applying a positive photosensitive resin composition on said semiconductor chip and drying said composition to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said protective layer or insulating layer,

wherein the heating step causes the activated silicon compound to generate a silanol group which reacts with the aluminum complex compound to generate a Bronsted acid which catalyzes the cyclization of the alkali-soluble resin,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in Claim 1.

9. A process for manufacturing a display comprising a substrate, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display device, comprising

applying a positive photosensitive resin composition on said substrate to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said flattened layer or insulating layer,

wherein the heating step causes the activated silicon compound to generate a silanol group which reacts with the aluminum complex compound to generate a Bronsted acid which catalyzes the cyclization of the alkali-soluble resin,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in Claim 1.

10. A positive photosensitive resin composition comprising

(A) an alkali-soluble resin, which is a resin comprising a polybenzoxazole structure, a polybenzoxazole precursor structure, a polyimide structure, a polyimide precursor structure or a polyimide acid ester strucuture

(B) a diazoquinone compound,

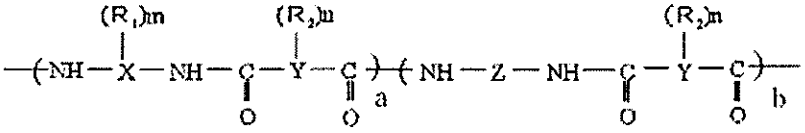
(C) a compound having two or more oxetanyl groups in one molecule, and

(D) a catalyst for accelerating the ring-opening reaction of said oxetanyl groups of compound (C), wherein said (D) component is selected from the group consisting of onium salts, halogenated organic compounds, quinone diazide compounds and sulfone compounds.

11. The positive photosensitive resin composition as claimed in Claim 10, wherein said (D) component is an acid-generating agent.

12. The positive photosensitive resin composition as claimed in Claim 10, wherein said (D) component comprises an aluminum complex and an activated silicon compound.

13. The positive photosensitive resin composition as claimed in Claim 10, wherein said (A) alkali-soluble resin is a resin represented by general formula (1):



(1)

wherein X and Y are an organic group; a and b represent a molar percentage, a + b = 100, a is 60 or more and 100 or less and b is 0 or more and 40 or less; R_1 is a hydroxy group or -O-R_3, which may be the same or different; R_2 is a hydroxy group, a carboxyl group, -O-R_3 or -COO-R_3, which may be the same or different; m is a

positive number of 0 to 2; n is a positive number of 0 to 4; R_3 is an organic group having 1 to 15 carbon atoms, where when R_1s are not a hydroxy group, at least one of R_2s must be a carboxyl group and where when R_2s are not a carboxyl group, at least one of R_1s must be a hydroxy group; Z is represented by $-R_4-Si(R_6)(R_7)-O-Si(R_6)(R_7)-R_5-$ where R_4 to R_7 are an organic group.

14. A patterning process comprising

applying the positive photosensitive resin composition as claimed in Claim 10 on a substrate to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam and then

heating said resin layer.

15. A semiconductor device, comprising

a semiconductor substrate,

a semiconductor chip formed on or over said semiconductor substrate,

a protective layer or insulating layer formed over said semiconductor chip,

wherein said protective layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive resin composition as claimed in Claim 10.

16. A display comprising a substrate for a display device, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display device,

wherein said flattened layer or insulating layer is a layer formed by applying, developing and heating the positive photosensitive resin composition as claimed in Claim 10.

17. A process for manufacturing a semiconductor device

comprising a semiconductor chip and a protective layer or insulating layer formed over said semiconductor chip, comprising

applying a positive photosensitive resin composition on said semiconductor chip and drying said composition to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said protective layer or insulating layer,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in Claim 10.

18. A process for manufacturing a display comprising a substrate, a flattened layer or insulating layer covering the surface of said substrate and a display device formed over said substrate for a display device, comprising

applying a positive photosensitive resin composition on said substrate and drying the composition to form a resin layer,

irradiating a desired area in said resin layer with an active energy beam,

developing said resin layer after the irradiation with an active energy beam, and then

heating said resin layer to form said flattened layer or insulating layer,

wherein said positive photosensitive resin composition is the positive photosensitive resin composition as claimed in Claim 10.