CLAIMS

1. A positive photosensitive resin composition for spray coating for forming a coating film on the inner surface of a hole provided in the thickness direction of a semiconductor wafer, wherein the positive photosensitive resin composition comprises:
(A) an alkali-soluble resin;
(B) a compound which generates an acid when exposed to light; and
(C) a solvent,
and has a viscosity of 0.5 to 200 cP.

2. The positive photosensitive resin composition according to claim 1, wherein the dynamic viscosity ratio A ($\eta 0.1/\eta 100$) between a dynamic viscosity of $\eta 0.1$ at a shear velocity of 0.1 rpm/s and a dynamic viscosity of $\eta 100$ at a shear velocity of 100 rpm/s is 1.5 to 400 and the dynamic viscosity ratio B ($\eta 100/\eta 1000$) between the dynamic viscosity of $\eta 100$ and a dynamic viscosity of $\eta 1000$ at a shear velocity of 1000/s is 0.6 to 5.0.

3. The positive photosensitive resin composition according to claim 1 or 2, wherein the solvent comprises a first solvent having a boiling point of 140°C to 210°C and a second solvent having a boiling point of 50°C to 140°C.

4. The positive photosensitive resin composition according to claim 1 or 2, wherein the solvent comprises a first solvent having a boiling point of 140°C to 210°C and a second solvent having a boiling point of 50°C to 120°C.

5. The positive photosensitive resin composition according to claim 3 or 4, wherein the first solvent dissolves the alkali-soluble resin and the second solvent improves the volatile property of the positive photosensitive resin composition.

6. The positive photosensitive resin composition according to any one of claims 3 to 5, wherein the first solvent comprises γ-butyrolactone.

7. The positive photosensitive resin composition according to anyone of claims 3 to 6, wherein the second solvent comprises at least one substance selected from the group consisting of ethyl acetate, 2-methyltetrahydrofuran, ethyl propionate, t-butyl acetate,

propylene glycol monomethyl ether, 3-methyltetrahydrofuran, s-butyl acetate, n-butyl acetate and isobutyl acetate.

8. The positive photosensitive resin composition according to anyone of claims 3 to 7, wherein the content of the second solvent is 50 to 95 wt% of the entire solvent.

9. The positive photosensitive resin composition according to anyone of claims 1 to 8, wherein the alkali-soluble resin is selected from: a resin having at least one of a polybenzoxazole structure and a polyimide structure, wherein the main chain or side chain thereof has a hydroxyl group, a carboxyl group, an ether group, an ester group or a combination thereof; a resin having a polybenzoxazole precursor structure; a resin having a polyimide precursor structure; and a resin having a polyamic acid ester structure.

10. The positive photosensitive resin composition according to anyone of claims 1 to 9, wherein the content of the alkali-soluble resin is 0.1 to 50 wt% of the entire composition.

11. The positive photosensitive resin composition according to anyone of claims 1 to 10, wherein the compound which generates an acid when exposed to light comprises an ester compound obtained by reacting a phenol compound with one of 1,2-naphthoquinone-2-diazide-5-sulfonic acid and 1,2-naphthoquinone-2-diazide-4-sulfonic acid.

12. The positive photosensitive resin composition according to anyone of claims 1 to 11, wherein the content of the compound which generates an acid when exposed to light is 1 to 50 wt% of the content of the alkali-soluble resin.

13. The positive photosensitive resin composition according to anyone of claims 1 to 12, wherein the wet-spreading property, which is defined by the ratio (A/B) between the maximum value A of the dropping length in the vertical direction and the maximum value B of the spreading width in the horizontal direction of a coating film that is

obtained by dropping one drop of the positive photosensitive resin composition (15 mg) on a silicon wafer in which a contact angle at the time of measurement using γ-butyrolactone is 89 to 97° and arranging and fixing the silicon wafer so as to stand with an angle of 80° to be left for 3 minutes, is 0.1 to 20.

14. A method for producing a through electrode for electrically connecting an integrated circuit provided on the surface of a semiconductor wafer and a connecting terminal provided on the back surface of the semiconductor wafer, comprising:
a coating film forming step in which a coating film is formed by applying the positive photosensitive resin composition according to anyone of claims 1 to 11 by means of spray coating so as to cover the inner surface of a hole provided in the thickness direction of the semiconductor wafer so that at least a portion of the back surface of an electrode portion of the integrated circuit provided on the surface of the semiconductor wafer is exposed; and
a pattern forming step in which at least a portion of the coating film formed on the back surface of the electrode portion is exposed and thereafter the exposed portion is developed, thereby forming a coating film pattern in which at least a portion of the back surface of the electrode portion is exposed.

15. The method for producing a through electrode according to claim 14, further comprising a metal film forming step in which a metal film is formed on the coating film pattern formed in the pattern forming step in order to electrically connect the back surface of the electrode portion and the connecting terminal provided on the back surface of the semiconductor wafer.

CLAIMS

1. A positive photosensitive resin composition for spray coating for forming a coating film on the inner surface of a hole provided in the thickness direction of a semiconductor wafer, wherein the positive photosensitive resin composition comprises:
(A) an alkali-soluble resin;
(B) a compound which generates an acid when exposed to light; and
(C) a solvent,
and has a viscosity of 0.5 to 200 cP,
wherein the dynamic viscosity ratio A ($\eta 0.1/\eta 100$) between a dynamic viscosity of $\eta 0.1$ at a shear rate of 0.1 /s and a dynamic viscosity of $\eta 100$ at a shear rate of 100 /s is 1.5 to 400 and the dynamic viscosity ratio B ($\eta 100/\eta 1000$) between the dynamic viscosity of $\eta 100$ and a dynamic viscosity of $\eta 1000$ at a shear rate of 1000/s is 0.6 to 5.0.

2. The positive photosensitive resin composition according to claim 1, wherein the solvent comprises a first solvent having a boiling point of 140°C to 210°C and a second solvent having a boiling point of 50°C to 140°C.

3. The positive photosensitive resin composition according to claim 1, wherein the solvent comprises a first solvent having a boiling point of 140°C to 210°C and a second solvent having a boiling point of 50°C to 120°C.

4. The positive photosensitive resin composition according to claim 2 or 3, wherein the first solvent dissolves the alkali-soluble resin and the second solvent improves the volatile property of the positive photosensitive resin composition.

5. The positive photosensitive resin composition according to any one of claims 2 to 4, wherein the first solvent comprises γ-butyrolactone.

6. The positive photosensitive resin composition according to any one of claims 2 to 5, wherein the second solvent comprises at least one substance selected from the group consisting of ethyl acetate, 2-methyltetrahydrofuran, ethyl propionate, t-butyl acetate, propylene glycol monomethyl ether, 3-methyltetrahydrofuran, s-butyl acetate, n-butyl acetate and isobutyl acetate.

7. The positive photosensitive resin composition according to any one of claims 2 to 6, wherein the content of the second solvent is 50 to 95 wt% of the entire solvent.

8. The positive photosensitive resin composition according to any one of claims 1 to 7, wherein the alkali-soluble resin is selected from: a resin having at least one of a polybenzoxazole structure and a polyimide structure, wherein the main chain or side chain thereof has a hydroxyl group, a carboxyl group, an ether group, an ester group or a combination thereof; a resin having a polybenzoxazole precursor structure; a resin having a polyimide precursor structure; and a resin having a polyamic acid ester structure.

9. The positive photosensitive resin composition according to any one of claims 1 to 8, wherein the content of the alkali-soluble resin is 0.1 to 50 wt% of the entire composition.

10. The positive photosensitive resin composition according to any one of claims 1 to 9, wherein the compound which generates an acid when exposed to light comprises an ester compound obtained by reacting a phenol compound with one of 1,2-naphthoquinone-2-diazide-5-sulfonic acid and 1,2-naphthoquinone-2-diazide-4-sulfonic acid.

11. The positive photosensitive resin composition according to any one of claims 1 to 10, wherein the content of the compound which generates an acid when exposed to light is 1 to 50 wt% of the content of the alkali-soluble resin.

12. The positive photosensitive resin composition according to any one of claims 1 to 11, wherein the wet-spreading property, which is defined by the ratio (A/B) between the maximum value A of the dropping length in the vertical direction and the maximum value B of the spreading width in the horizontal direction of a coating film that is obtained by dropping one drop of the positive photosensitive resin composition (15 mg) on a silicon wafer in which a contact angle at the time of measurement using γ-butyrolactone is 89 to 97° and arranging and fixing the silicon wafer so as to stand with an angle of 80° to be left for 3 minutes, is 0.1 to 20.

13. A method for producing a through electrode for electrically connecting an integrated circuit provided on the surface of a semiconductor wafer and a connecting terminal provided on the back surface of the semiconductor wafer, comprising:

a coating film forming step in which a coating film is formed by applying the positive photosensitive resin composition according to any one of claims 1 to 12 by means of spray coating so as to cover the inner surface of a hole provided in the thickness direction of the semiconductor wafer so that at least a portion of the back surface of an electrode portion of the integrated circuit provided on the surface of the semiconductor wafer is exposed; and

a pattern forming step in which at least a portion of the coating film formed on the back surface of the electrode portion is exposed and thereafter the exposed portion is developed, thereby forming a coating film pattern in which at least a portion of the back surface of the electrode portion is exposed.

14. The method for producing a through electrode according to claim 13, further comprising a metal film forming step in which a metal film is formed on the coating film pattern formed in the pattern forming step in order to electrically connect the back surface of the electrode portion and the connecting terminal provided on the back surface of the semiconductor wafer.

15. The method for producing a through electrode according to claim 13, further comprising a metal film forming step in the case where an insulating film mediates between the inner surface of the hole and the coating film, wherein: an insulating film pattern is formed using the coating film pattern formed in the pattern forming step as a mask for forming the insulating film pattern; and a metal film is formed on the obtained insulating film pattern in order to electrically connect the back surface of the electrode portion and the connecting terminal provided on the back surface of the semiconductor wafer.