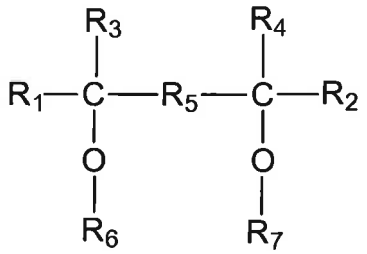
~~CLAIMS~~

1. A rinse solution for lithography, comprising water and a nonionic surfactant represented by the formula (I):



(I)

wherein, $R_1$ and $R_2$ may be the same as or different from each other and represent a hydrogen atom or a methyl group, $R_3$ and $R_4$ may be the same as or different from each other and represent a hydrogen atom, a methyl group or an ethyl group, $R_5$ represents a hydrocarbon group having 2 to 5 carbon atoms, in which one or more of a double bond or triple bond are contained, or a phenylene group, and $R_6$ and $R_7$ may be the same as or different from each other and represent a hydrogen atom or a methyl group.

2. The rinse solution for lithography according to claim 1, wherein a maximum dissolution quantity in water of 25°C of the nonionic surfactant represented by the formula (I) above is more than 5,000 ppm.

3. The rinse solution for lithography according to claim 1 or 2, wherein the nonionic surfactant represented by the formula (I) above is at least one selected from 3-hexene-2,5-diol, 1,4-butynediol, 3-~~hexyne-2,5-diol, 2,5-dimethyl-3-hexyne-2,5-diol,~~

~~3,6-dimethyl-4-octyn-3,6-diol, 2,4-hexadiyn-1,6-diol,~~ 1,2-benzenedimethanol, 1,3-benzenedimethanol, p-xylylene glycol, and 4-bis(methoxymethyl)benzene.

4. The rinse solution for lithography according to any one of claims 1 to 3, wherein the nonionic surfactant represented by the formula (I) above is contained in the rinse solution in a content of 0.02 to 0.5 % by mass.

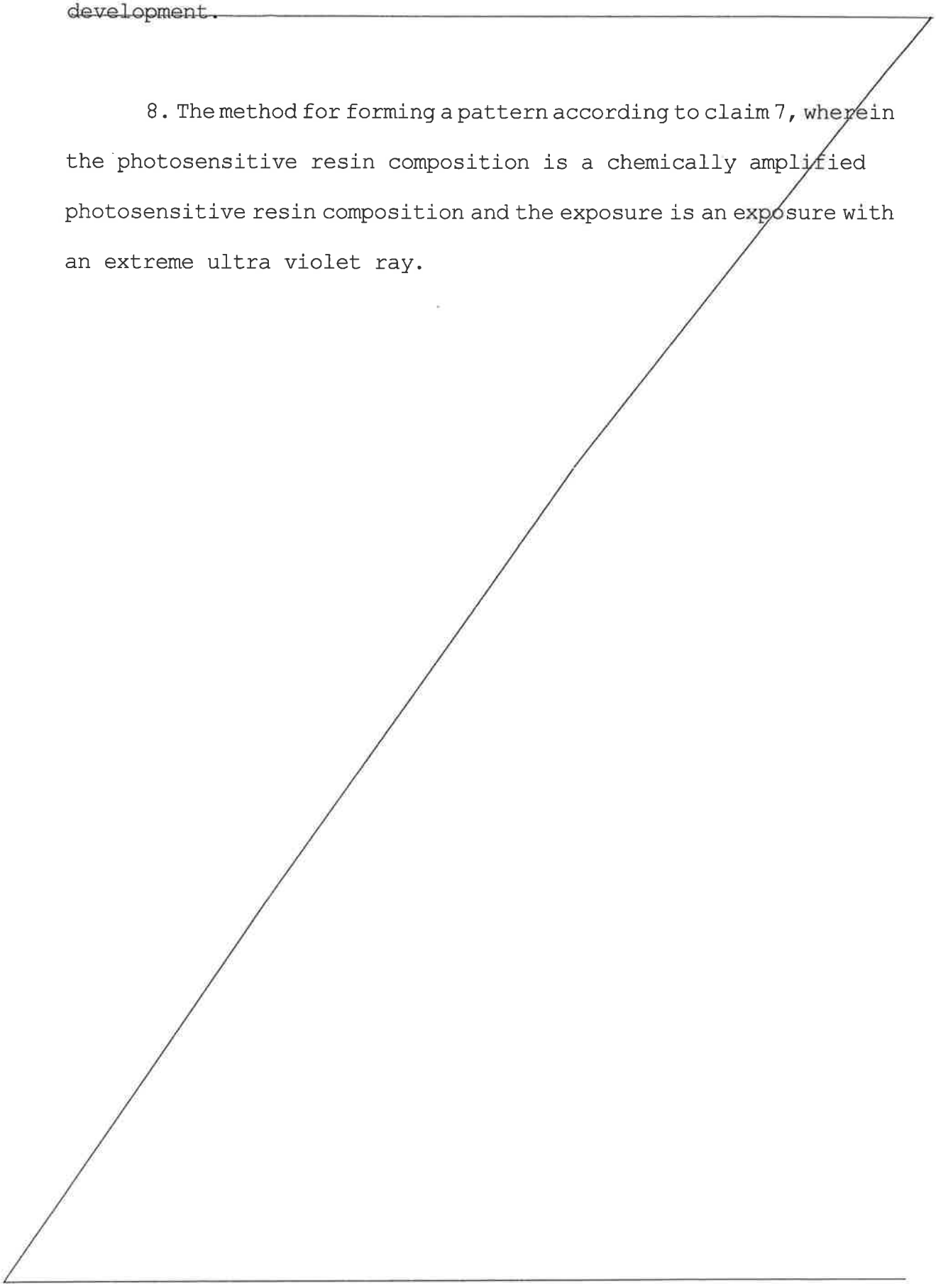
5. The rinse solution for lithography according to any one of claims 1 to 4, wherein at least one of an acid, a base, a organic solvent and a surfactant excluding a surfactant represented by the formula (I) is further contained.

6. The rinse solution for lithography according to any one of claims 1 to 5, wherein at least one of an antimicrobial, an antibacterial, an antiseptic, and a fungicide is further contained.

7. A method for forming a pattern, comprising;
(1) a step of forming a photosensitive resin composition layer by applying a photosensitive resin composition on a substrate,
(2) a step of exposing the photosensitive resin composition layer,
(3) a step of developing the exposed photosensitive resin composition layer, and
(4) a step of rinsing the developed layer with the rinse solution for lithography according to any one of claims 1 to 6 after the

development.

8. The method for forming a pattern according to claim 7, wherein the photosensitive resin composition is a chemically amplified photosensitive resin composition and the exposure is an exposure with an extreme ultra violet ray.



CLAIMS

1. A method for forming a pattern, comprising;

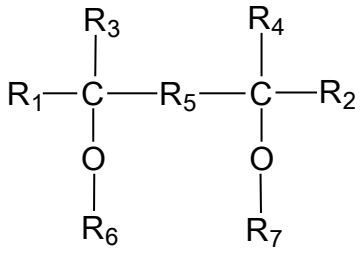
(1) a step of forming a photosensitive resin composition layer by applying a photosensitive resin composition on a substrate,

(2) a step of exposing the photosensitive resin composition layer,

(3) a step of developing the exposed photosensitive resin composition layer, and

(4) a step of rinsing the developed layer with a rinse solution for lithography after the development,

wherein the rinse solution for lithography comprises water and a nonionic surfactant represented by the formula (I):



( I )

wherein, $R_1$ and $R_2$ may be the same as or different from each other and represent a hydrogen atom or a methyl group, $R_3$ and $R_4$ may be the same as or different from each other and represent a hydrogen atom, a methyl group or an ethyl group, $R_5$ represents a hydrocarbon group having 2 to 5 carbon atoms, in which one or more of a double bond or triple bond are contained, or a phenylene group, and $R_6$ and $R_7$ may be the same as or different from each other and represent a hydrogen atom or a methyl group.

2. The method for forming a pattern according to claim 1, wherein a maximum dissolution quantity in water of 25℃ of the nonionic surfactant represented by the formula (I) above is more than 5,000 ppm.

3. The method for forming a pattern according to claim 2, wherein the nonionic surfactant represented by the formula (I) above is contained in the rinse solution in a content of 0.02 to 0.5% by mass.

4. The method for forming a pattern according to claim 2, wherein the nonionic surfactant represented by the formula (I) above is contained in the rinse solution in a content of 0.02 to 0.5% by mass and further wherein at least one of an acid, a base, an organic solvent and a surfactant excluding a surfactant represented by the formula (I) is further contained.

5. The method for forming a pattern according to claim 2, wherein the nonionic surfactant represented by the formula (I) above is contained in the rinse solution in a content of 0.02 to 0.5% by mass and further wherein at least one of an acid, a base, an organic solvent and a surfactant excluding a surfactant represented by the formula (I) is further contained and further wherein at least one of an antimicrobial, an antibacterial, an antiseptic, and a fungicide is contained.

6. The method for forming a pattern according to claim 1, wherein the nonionic surfactant represented by the formula (I) above is at least one selected from 3-hexene-2,5-diol, 1,4-butynediol, 3-hexyne-2,5-diol, 2,5-dimethyl-3-hexyne-2,5-diol, 3,6-dimethyl-4-octyn-3,6-diol, 2,4-hexadiyn-1,6-diol, 1,2-benzenedimethanol, 1,3-benzenedimethanol, p-xylylene glycol, and 4-bis(methoxymethyl)benzene.

7. The method for forming a pattern according to claim 1, wherein the nonionic surfactant represented by the formula (I) above is contained in the rinse solution in a content of 0.02 to 0.5% by mass.

8. The method for forming a pattern according to claim 1, wherein at least one of an acid, a base, an organic solvent and a surfactant excluding a surfactant represented by the formula (I) is further contained.

9. The method for forming a pattern according to claim 1, wherein at least one of an antimicrobial, an antibacterial, an antiseptic, and a fungicide is further contained.

10. The method for forming a pattern according to claim 1, wherein the photosensitive resin composition is a chemically amplified photosensitive resin composition and the exposure is an exposure

with an extreme ultra violet ray.

11. The method for forming a pattern according to claim 1, wherein the nonionic surfactant represented by the formula (I) above is at least one selected from 3-hexene-2,5-diol, 1,4-butynediol, 3-hexyne-2,5-diol, 2,5-dimethyl-3-hexyne-2,5-diol, 3,6-dimethyl-4-octyn-3,6-diol, 2,4-hexadiyn-1,6-diol, 1,2-benzenedimethanol, 1,3-benzenedimethanol, p-xylylene glycol, and 4-bis(methoxymethyl)benzene and is contained in the rinse solution in a content of 0.02 to 0.5% by mass.

12. The method for forming a pattern according to claim 1, wherein the nonionic surfactant represented by the formula (I) above is at least one selected from 3-hexene-2,5-diol, 1,4-butynediol, 3-hexyne-2,5-diol, 2,5-dimethyl-3-hexyne-2,5-diol, 3,6-dimethyl-4-octyn-3,6-diol, 2,4-hexadiyn-1,6-diol, 1,2-benzenedimethanol, 1,3-benzenedimethanol, p-xylylene glycol, and 4-bis(methoxymethyl)benzene and is contained in the rinse solution in a content of 0.02 to 0.5% by mass and further wherein at least one of an acid, a base, an organic solvent and a surfactant excluding a surfactant represented by the formula (I) is further contained.

13. The method for forming a pattern according to claim 1, wherein the nonionic surfactant represented by the formula (I) above is at least one selected from 3-hexene-2,5-diol, 1,4-butynediol,

3-hexyne-2,5-diol, 2,5-dimethyl-3-hexyne-2,5-diol, 3,6-dimethyl-4-octyn-3,6-diol, 2,4-hexadiyn-1,6-diol, 1,2-benzenedimethanol, 1,3-benzenedimethanol, p-xylylene glycol, and 4-bis(methoxymethyl)benzene and is contained in the rinse solution in a content of 0.02 to 0.5% by mass and further wherein at least one of an acid, a base, an organic solvent and a surfactant excluding a surfactant represented by the formula (I) is further contained and further wherein at least one of an antimicrobial, an antibacterial, an antiseptic, and a fungicide is contained.

14. The method for forming a pattern according to claim 1, wherein $R_5$ represents a hydrocarbon group having 2 to 5 carbon atoms, in which one or more of a double bond or triple bond are contained.

15. The method for forming a pattern according to claim 1, wherein $R_5$ represents -CH=CH-, -C≡C-, or -C≡C-$CH_2$-C≡C-.

16. A manufacturing method of semiconductor devices, flat panel displays or color filters comprising the pattern forming method of claim 1.