Claims

1. Aqueous alkaline cleaning composition free from organic solvents and metal ion-free silicates, the said compositions comprising

(A) at least one thioamino acid having at least one primary amino group and at least one mercapto group,

(B) at least one quaternary ammonium hydroxide,

(C) at least one chelating and/or corrosion inhibiting agent selected from the group consisting of aliphatic and cycloaliphatic amines having at least two primary amino groups, and aliphatic and cycloaliphatic amines having at least one hydroxy group,

(D) at least one nonionic surfactant selected from the group of acetylenic alcohols, alkyloxylated acetylenic alcohols and alkyloxylated sorbitan monocarboxylic acid mono esters.

2. The aqueous alkaline cleaning compositions according to claim 1, wherein the amino acid (A) has the general formula I:

$HS-[-C(-R^1)(-R^2)-]_n-C(-R^3)(-NH_2)-COOH$ (I),

wherein the index and the variables have the following meaning:

n integer of 1 to 3;

R^1 and R^2 selected independently from each other from the group consisting of

- hydrogen atoms;
- straight and branched; saturated and unsaturated, substituted and unsubstituted aliphatic residues having 1 to 10 carbon atoms;
- substituted and unsubstituted, saturated and unsaturated cycloalkyl residues having 3 to 8 carbon atoms;

- substituted and unsubstituted, saturated and unsaturated alkylcycloalkyl residues wherein the alkyl group is having from 1 to 4 carbon atoms and the cycloalkyl group is having from 3 to 8 carbon atoms;
- substituted and unsubstituted aryl having from 6 to 16 carbon atoms;
- substituted and unsubstituted alkylaryl residues wherein the alkyl group is having from 1 to 4 carbon atoms and the arylgroup is having from 6 to 16 carbon atoms;
- substituted and unsubstituted cycloalkylaryl residues wherein the cycloalkyl group is having from 3 to 8 carbon atoms and the arylgroup is having from 6 to 16 carbon atoms;
- substituted and unsubstituted heteroaryl residues having at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen and phosphorus atoms;
- substituted and unsubstituted alkylheteroaryl residues wherein the alkyl group is having from 1 to 4 carbon atoms and the heteroaryl group is having having at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen and phosphorus atoms;
- substituted and unsubstituted cycloalkylheteroaryl residues wherein the cycloalkyl group is having from 3 to 8 carbon atoms and the heteroaryl group is having at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen and phosphorus atoms
- substituted and unsubstituted arylheteroaryl residues wherein the aryl group is having from 6 to 16 carbon atoms and the heteroaryl group is having at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen and phosphorus atoms or, alternatively,

R^1 and R^2 together forming a saturated or unsaturated, substituted or unsubstituted ring having 3 to 6 carbon atoms, wherein no carbon atom or 1 or 2 carbon atoms is or are replaced by one hetero atom

selected from the group consisting of oxygen, sulfur, nitrogen and phosphorus atoms;

R^3 single residue R^1 or R^2 or covalent bond or bivalent group linking the carbon atom carrying the amino group and the carboxyl group to one of the residues R^1 or R^2 or to the ring formed by the residues R^1 and R^2.

3. The aqueous alkaline cleaning composition according to claim 2, wherein the thioamino acid (A) is a racemic or an enantiomeric mixture or one of the respective enantiomers or diastereomers.

4. The aqueous alkaline cleaning composition according to claim 3, wherein at least one of the residues R^1, R^2 and R^3 is a hydrogen atom.

5. The aqueous alkaline cleaning composition according to claim 4, wherein all the the residues R^1, R^2 and R^3 of the thioamino acid (A) are hydrogen atoms.

6. The aqueous alkaline cleaning composition according to claim 5, wherein the thioamino acid (A) is L-cysteine.

7. The aqueous alkaline cleaning composition according to anyone of the claims 1 to 6, wherein the quaternary ammonium hydroxide (B) has the general formula II:

$N(-R^1)_4^+ \ OH^-$ (II),

wherein the residue R^1 is having the above defined meaning except hydrogen atom, whilst all the residues R^1 are the same or at least two residues R^1 are different from each other and all the residues R^1 are single residues or at least two residues R^1 form a saturated or unsaturated, substituted or unsubstituted ring having 3 to 6 carbon atoms, wherein no carbon atom or 1 or 2 carbon atoms are replaced by one hetero atom selected from the group of oxygen, sulfur, nitrogen and phosphorus atoms.

8. The aqueous alkaline cleaning composition according to claim 7, wherein the residue R^1 of the general formula (II) is methyl.

9. The aqueous alkaline cleaning composition according to anyone of the claims 1 to 8, wherein the aliphatic amine (C) having at least two primary amino groups is selected from the group consisting of ethylenediamine, propylenediamine, n-butylenediamine, diethylenetriamine, dipropylenetriamine, di-n-butylenetriamine, triethylenetetraamine, tripropylenetetraamine, and tri-n-butylenetetraamine; the cycloaliphatic amine (C) is selected from the group consisting of 1,2-, 1,3- and 1,4-diamino cyclohexane; the aliphatic amine (C) having at least one hydroxy group is selected from the group consisting of ethanolamine, diethanolamine and triethanolamine; and the cycloaliphatic amine (C) having at least one hydroxy group is selected from the group consisting of 2-, 3- and 4-hydroxy cyclohexylamine.

10. The aqueous alkaline cleaning composition according to anyone of the claims 1 to 9, wherein the nonionic surfactant (D) is selected from the group consisting of acetylenic monoalcohols and diols; alkyloxylated acetylenic monoalcohols and diols; and alkyloxylated sorbitan monocarboxylic acid fatty acid mono esters.

11. Aqueous alkaline cleaning composition according to anyone of the claims 1 to 11 furthermore comprising at least one functional additive (E) which is different from the components (A), (B), (C) and (D).

12. The aqueous alkaline cleaning composition according to claim 11, wherein the functional additive (E) is selected from the group consisting of corrosion inhibitors, bases, complexing or chelating agents, film forming agents, surfactants and pH-adjusting agents.

13. A method for processing substrates useful for fabricating electrical and optical devices, said method comprising the process step of contacting the substrate surface at least once with at least one aqueous alkaline cleaning composition according to anyone of the claims 1 to 12.

14. The method according to claim 13, wherein the process step is at least one surface preparation step, pre-plaiting cleaning step, post-etch cleaning step or post-chemical polishing cleaning step.

15. The method according to claim 13 or 14, wherein the electrical devices are semiconductor integrated circuits (ICs); liquid crystal panels; organic electroluminescent panels; printed circuit boards; micro machines; DNA chips; micro plants and magnetic heads; and the optical devices are optical glasses; inorganic electro-conductive films; optical integrated circuits; optical switching elements; optical waveguides; optical monocrystals; solid laser monocrystals; sapphire substrates for blue laser LEDs; semiconductor monocrystals; and glass substrates for magnetic disks.

16. The use of the aqueous alkaline cleaning composition according to anyone of the claims 1 to 12 for the processing of substrates useful for fabricating electrical and optical devices.

17. The use according to claim 16 for the surface preparation, pre-plaiting cleaning, post-etch cleaning and post-chemical mechanical polishing cleaning of the substrates.

Claims

1. An aqueous alkaline composition free from organic solvents and metal ion-free silicates, wherein the composition comprises:

(A) a thioamino acid comprising a primary amino group and a mercapto group;

(B) a quaternary ammonium hydroxide;

(C) at least one chelating and/or corrosion inhibiting agent selected from the group consisting of an aliphatic amine comprising at least two primary amino groups, a cycloaliphatic amine comprising at least two primary amino groups, an aliphatic amine comprising a hydroxyl group, and a cycloaliphatic amine comprising a hydroxy group; and

(D) at least one nonionic surfactant selected from the group consisting of an acetylenic alcohol, an alkyloxylated acetylenic alcohol, and an alkyloxylated sorbitan monocarboxylic acid mono ester.

2. The aqueous alkaline composition of claim 1, wherein the thioamino acid (A) has formula (I):

$$HS\text{-}[\text{-}C(\text{-}R^1)(\text{-}R^2)\text{-}]_n\text{-}C(\text{-}R^3)(\text{-}NH_2)\text{-}COOH \qquad (I),$$

wherein:

n is an integer of from 1 to 3;

R^1 and R^2 are each independently selected from the group consisting of

a hydrogen atom;

a straight or branched, saturated or unsaturated, substituted or unsubstituted aliphatic residue comprising from 1 to 10 carbon atoms;

a substituted or unsubstituted, saturated or unsaturated cycloalkyl residue comprising from 3 to 8 carbon atoms;

a substituted or unsubstituted, saturated or unsaturated alkylcycloalkyl residue, wherein the alkyl groups comprise from 1 to 4 carbon atoms and the cycloalkyl group comprises from 3 to 8 carbon atoms;

a substituted or unsubstituted aryl residue comprising from 6 to 16 carbon atoms;

a substituted or unsubstituted alkylaryl residue, wherein the alkyl group comprises from 1 to 4 carbon atoms and the aryl group comprises from 6 to 16 carbon atoms;

a substituted or unsubstituted cycloalkylaryl residue, wherein the cycloalkyl group comprises from 3 to 8 carbon atoms and the aryl group comprises from 6 to 16 carbon atoms;

a substituted or unsubstituted heteroaryl residue comprising at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen, and phosphorus;

a substituted and unsubstituted alkylheteroaryl residue, wherein the alkyl group comprises from 1 to 4 carbon atoms and the heteroaryl group comprises at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen, and phosphorus;

a substituted or unsubstituted cycloalkylheteroaryl residue, wherein the cycloalkyl group comprises from 3 to 8 carbon atoms and the heteroaryl group comprises at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen, and phosphorus; and

a substituted or unsubstituted arylheteroaryl residue, wherein the aryl groups comprise from 6 to 16 carbon atoms and the heteroaryl group comprises at least one hetero atom selected from the group consisting of oxygen, sulfur, nitrogen, and phosphorus;

or, alternatively, R^1 and R^2 together forming form a saturated or unsaturated, substituted or unsubstituted ring comprising from 3 to 6 carbon atoms, wherein at most 2 carbon atoms are replaced by a hetero atom selected from the group consisting of oxygen, sulfur, nitrogen, and phosphorus; and

R^3 is a single residue R^1 or R^2, a covalent bond, or a bivalent group linking the carbon atom carrying the amino group and the carboxyl group to one of the residues R^1 or R^2 or to the ring formed by the residues R^1 and R^2.

3. The aqueous alkaline composition of claim 2, wherein the thioamino acid (A) is a racemic mixture, an enantiomeric mixture, or one of enantiomers or diastereomers thereof.

4. The aqueous alkaline composition of claim 3, wherein at least one of the residues R^1, R^2, and R^3 is a hydrogen atom.

5. The aqueous alkaline composition of claim 4, wherein all of the residues R^1, R^2, and R^3 of the thioamino acid (A) are hydrogen atoms.

6. The aqueous alkaline composition of claim 5, wherein the thioamino acid (A) is L-cysteine.

7. The aqueous alkaline composition of claim 2, wherein the quaternary ammonium hydroxide (B) has formula (II):

$$N(-R^1)_4{}^{+}OH^- \qquad \text{(II)},$$

wherein the residue R^1 has the same meaning as in formula (I), except the hydrogen atom, whilst all the residues R^1 are the same or at least two residues R^1 are different from each other, and all the residues R^1 are single residues or at least two residues R^1 form a saturated or unsaturated, substituted or unsubstituted ring comprising from 3 to 6 carbon atoms, wherein at most 2 carbon atoms are replaced by a hetero atom selected from the group consisting of oxygen, sulfur, nitrogen, and phosphorus.

8. The aqueous alkaline composition of claim 7, wherein, in formula (II), the residue R^1 is methyl.

9. The aqueous alkaline composition of claim 1, wherein: the aliphatic amine (C) comprising at least two primary amino groups are selected from the group consisting of ethylenediamine, propylenediamine, n-butylenediamine, diethylenetriamine, dipropylenetriamine, di-n-butylenetriamine, triethylenetetraamine, tripropylenetetraamine, and tri-n-butylenetetraamine;

the cycloaliphatic amine (C) comprising at least two primary amino groups are selected from the group consisting of 1,2-diamino cyclohexane, 1,3-diamino cyclohexane, and 1,4-diamino cyclohexane;

the aliphatic amine (C) comprising at least one hydroxy group is selected from the group consisting of ethanolamine, diethanolamine and triethanolamine; and

the cycloaliphatic amine (C) comprising at least one hydroxy group is selected from the group consisting of 2-hydroxy cyclohexylamine, 3-hydroxy cyclohexylamine, and 4-hydroxy cyclohexylamine.

10. The aqueous alkaline composition of claim 1, wherein the nonionic surfactant (D) is selected from the group consisting of an acetylenic monoalcohol, an acetylenic diol, an alkyloxylated acetylenic monoalcohol, an alkyloxylated acetylenic diol, and an alkyloxylated sorbitan monocarboxylic acid fatty acid mono ester.

11. The aqueous alkaline composition of claim 1, further comprising: a functional additive (E), which is different from the components (A), (B), (C), and (D).

12. The aqueous alkaline composition of claim 11, wherein the functional additive (E) is selected from the group consisting of a corrosion inhibitor, a base, a complexing or chelating agent, a film forming agent, a surfactant, and a pH-adjusting agent.

13. A method for processing an electrical or optical device substrate, the method comprising:

contacting a substrate surface with the aqueous alkaline composition of claim 1.

14. The method of claim 13, wherein the processing is a surface preparation, pre-plaiting cleaning, post-etch, or post-chemical polishing cleaning.

15. The method of claim 13,

wherein the electrical device substrate is a semiconductor integrated circuit (IC); a liquid crystal panel; an organic electroluminescent panel; a printed circuit board; a micro machine; a DNA chip; a micro plant, or a magnetic head substrate.

16. The aqueous alkaline composition of claim 1, wherein the thioamino acid (A) is cysteine or homocysteine.

17. The aqueous alkaline composition of claim 7, wherein, in formula (II), each R^1 in the quaternary ammonium hydroxide (B) is independently methyl, ethyl, propyl, isopropyl, n-butyl, sec-butyl, iso-butyl, tert-butyl, n-pentyl, 2hydroxyethyl, 2-hydroxypropyl, 3-hydroxypropyl, or 4-hydroxy-n-butyl group.

18. The method of claim 13, wherein the optical device substrate is an optical glass, an inorganic electro-conductive film, an optical integrated circuit, an optical switching element, an optical waveguide, an optical monocrystal, a solid laser monocrystal, a blue laser LED sapphire substrate, a semiconductor monocrystal, and a magnet disk glass substrate.