CLAIMS

1. A polishing composition comprising:

at least one abrasive;

at least one nitride removal rate reducing agent comprising:

a hydrophobic portion comprising a C_4 to C_{40} hydrocarbon group; and

a hydrophilic portion comprising at least one group selected from the group consisting of a sulfinite group, a sulfate group, a sulfonate group, a carboxylate group, a phosphate group, and a phosphonate group; and

wherein the hydrophobic portion and the hydrophilic portion are separated by zero to ten alkylene oxide groups;

at least one metal corrosion inhibitor different from the at least one nitride removal rate reducing agent, the at least one metal corrosion inhibitor comprising an amino acid, a phosphonate surfactant, a phosphate surfactant, a sulfate surfactant, a sulfonate surfactant, a glucamide surfactant, an azole, an imide, an oxazole, a thiourea, or a Schiff base;

an acid or a base; and

water;

wherein the polishing composition has a pH of from about 2 to about 6.5.

2. The polishing composition of claim 1, wherein the at least one metal corrosion inhibitor comprises benzotriazole, histidine, glycine, hexyl phosphate, hexyl ethyl phosphate, 2-ethylhexyl phosphate, or dodecylbenzenesulfonic acid.

3. The polishing composition of claim 1, wherein the at least one metal corrosion inhibitor is in an amount of from about 0.1 ppm to about 1 wt% of the composition.

4. The polishing composition of claim 1, wherein the hydrophobic portion comprises a C_{12} to C_{32} hydrocarbon group.

5. The polishing composition of claim 4, wherein the hydrophobic portion comprises a C_{16} to C_{22} hydrocarbon group.

6. The polishing composition of claim 1, wherein the hydrophilic portion comprises a phosphate group or a phosphonate group.

7. The polishing composition of claim 1, wherein the at least one nitride removal rate reducing agent is selected from the group consisting of napthalenesulfonic acid-formalin condensate, lauryl phosphate, myristyl phosphate, stearyl phosphate, octadecylphosphonic acid, oleyl phosphate, behenyl phosphate, octadecyl sulfate, lacceryl phosphate, oleth-3-phosphate, and oleth-10-phosphate.

8. The polishing composition of claim 1, wherein the at least one nitride removal rate reducing agent has zero alkylene oxide group separating the hydrophobic portion and the hydrophilic portion.

9. The polishing composition of claim 1, wherein the at least one nitride removal rate reducing agent is in an amount of from about 0.1 ppm to about 1000 ppm of the composition.

10. The polishing composition of claim 1, wherein the polishing composition has a ratio of a removal rate for a silicon oxide to a removal rate for a silicon nitride of at least about 3:1.

11. The polishing composition of claim 1, wherein the polishing composition has a ratio of a removal rate for a silicon oxide to a removal rate for a silicon nitride of at least about 100:1.

~~12. The polishing composition of claim 1, wherein the at least one abrasive is selected from the group consisting of cationic abrasives, substantially neutral abrasives, and anionic abrasives.~~

~~13. The polishing composition of claim 12, wherein the at least one abrasive is selected from the group consisting of alumina, silica, titania, ceria, zirconia, co-formed products thereof, coated abrasives, surface modified abrasives, and mixtures thereof.~~

~~14. The polishing composition of claim 1, wherein the at least one abrasive is in an amount of from about 0.05 wt% to about 20 wt% of the composition.~~

~~15. The composition of claim 1, wherein the acid is selected from the group consisting of formic acid, acetic acid, malonic acid, citric acid, propionic acid, malic acid, adipic acid, succinic acid, lactic acid, oxalic acid, hydroxyethylidene diphosphonic acid, 2-phosphono-1,2,4-butane tricarboxylic acid, aminotrimethylene phosphonic acid, hexamethylenediamine tetra(methylenephosphonic acid), bis(hexamethylene)triamine phosphonic acid, amino acetic acid, peracetic acid, potassium acetate, phenoxyacetic acid, glycine, bicine, diglycolic acid, glyceric acid, tricine, alanine, histidine, valine, phenylalanine, proline, glutamine, aspartic acid, glutamic acid, arginine, lysine, tyrosine, benzoic acid, nitric acid, sulfuric acid, sulfurous acid, phosphoric acid, phosphonic acid, hydrochloric acid, periodic acid, and mixtures thereof.~~

~~16. The composition of claim 1, wherein the base is selected from the group consisting of potassium hydroxide, sodium hydroxide, cesium hydroxide, ammonium hydroxide, triethanolamine, diethanolamine, monoethanolamine, tetrabutylammonium hydroxide, tetramethylammonium hydroxide, lithium hydroxide, imidazole, triazole, aminotriazole, tetrazole, benzotriazole, tolytriazole, pyrazole, isothiazole, and mixtures thereof.~~

~~17. A method, comprising:~~

~~applying the polishing composition of claim 1 to a substrate having at least a silicon nitride and at least a silicon oxide on a surface of the substrate; and~~

~~bringing a pad into contact with the surface of the substrate and moving the pad in relation to the substrate.~~

~~18. The method of claim 17, wherein at least one of the silicon nitride and silicon oxide is doped with at least one dopant selected from the group consisting of carbon, nitrogen, oxygen, and hydrogen.~~

~~19. The method of claim 18, further comprising forming a semiconductor device from the substrate.~~

1. A polishing composition comprising:

at least one abrasive;

at least one nitride removal rate reducing agent in an amount of from about 0.1 ppm to about 1000 ppm of the composition, the at least one nitride removal rate reducing agent comprising:

a hydrophobic portion comprising a C_4 to C_{40} hydrocarbon group; and

a hydrophilic portion comprising at least one group selected from the group consisting of a sulfinite group, a phosphate group, and a phosphonate group; and

wherein the hydrophobic portion and the hydrophilic portion are separated by zero alkylene oxide group;

at least one metal corrosion inhibitor different from the at least one nitride removal rate reducing agent;

an acid or a base; and

water;

wherein the polishing composition is free of an oxidizing agent and a salt, and the polishing composition has a pH of from about 2 to about 6.5.

2. The polishing composition of claim 1, wherein the at least one metal corrosion inhibitor comprises an amino acid, a phosphonate surfactant, a phosphate surfactant, a sulfate surfactant, a sulfonate surfactant, a glucamide surfactant, an azole, an imide, an oxazole, a thiourea, or a Schiff base.

3. The polishing composition of claim 1, wherein the at least one metal corrosion inhibitor comprises benzotriazole, histidine, glycine, hexyl phosphate, hexyl ethyl phosphate, 2-ethylhexyl phosphate, or dodecylbenzenesulfonic acid.

4. The polishing composition of claim 1, wherein the at least one metal corrosion inhibitor is in an amount of from about 0.1 ppm to about 1 wt% of the composition.

5. The polishing composition of claim 1, wherein the hydrophobic portion comprises a C_{12} to C_{32} hydrocarbon group.

6. The polishing composition of claim 5, wherein the hydrophobic portion comprises a C_{16} to C_{22} hydrocarbon group.

7. The polishing composition of claim 1, wherein the hydrophilic portion comprises a phosphate group or a phosphonate group.

8. The polishing composition of claim 1, wherein the at least one nitride removal rate reducing agent is selected from the group consisting of lauryl phosphate, myristyl phosphate, stearyl phosphate, octadecylphosphonic acid, oleyl phosphate, behenyl phosphate, and lacceryl phosphate.

9. The polishing composition of claim 1, wherein the at least one nitride removal rate reducing agent is in an amount of from about 0.5 ppm to about 1000 ppm of the composition.

10. The polishing composition of claim 1, wherein the polishing composition has a ratio of a removal rate for a silicon oxide to a removal rate for a silicon nitride of at least about 3:1.

11. The polishing composition of claim 10, wherein the polishing composition has a ratio of a removal rate for a silicon oxide to a removal rate for a silicon nitride of at least about 100:1.

12. The polishing composition of claim 1, wherein the at least one abrasive is selected from the group consisting of cationic abrasives, substantially neutral abrasives, and anionic abrasives.

13. The polishing composition of claim 12, wherein the at least one abrasive is selected from the group consisting of alumina, silica, titania, ceria, zirconia, co-formed products thereof, coated abrasives, surface modified abrasives, and mixtures thereof.

14. The polishing composition of claim 1, wherein the at least one abrasive is in an amount of from about 0.05 wt% to about 20 wt% of the composition.

15. The composition of claim 1, wherein the acid is selected from the group consisting of formic acid, acetic acid, malonic acid, citric acid, propionic acid, malic acid, adipic acid, succinic acid, lactic acid, oxalic acid, hydroxyethylidene diphosphonic acid, 2-phosphono-1,2,4-butane tricarboxylic acid, aminotrimethylene phosphonic acid, hexamethylenediamine tetra(methylenephosphonic acid), bis(hexamethylene)triamine phosphonic acid, amino acetic acid, peracetic acid, potassium acetate, phenoxyacetic acid, glycine, bicine, diglycolic acid, glyceric acid, tricine, alanine, histidine, valine, phenylalanine, proline, glutamine, aspartic acid, glutamic acid, arginine, lysine, tyrosine, benzoic acid, nitric acid, sulfuric acid, sulfurous acid, phosphoric acid, phosphonic acid, hydrochloric acid, periodic acid, and mixtures thereof.

16. The composition of claim 1, wherein the base is selected from the group consisting of potassium hydroxide, sodium hydroxide, cesium hydroxide, ammonium hydroxide, triethanolamine, diethanolamine, monoethanolamine, tetrabutylammonium hydroxide, tetramethylammonium hydroxide, lithium hydroxide, imidazole, triazole, aminotriazole, tetrazole, benzotriazole, tolytriazole, pyrazole, isothiazole, and mixtures thereof.

17. A method, comprising:

applying the polishing composition of claim 1 to a substrate having at least a silicon nitride and at least a silicon oxide on a surface of the substrate; and

bringing a pad into contact with the surface of the substrate and moving the pad in relation to the substrate.

18. The method of claim 17, wherein at least one of the silicon nitride and silicon oxide is doped with at least one dopant selected from the group consisting of carbon, nitrogen, oxygen, and hydrogen.

19. The method of claim 17, further comprising forming a semiconductor device from the substrate.