CLAIMS

We claim:

1. A chemical mechanical polishing composition comprising:

an abrasive comprising silica particles;

0.01 wt.% to 10.0% wt.% of a first chemical additive, wherein the first chemical additive comprises a molecule comprising a quaternary ammonium compound;

between 0.005 wt.% and 1.0 wt.% of a second chemical additive, wherein the second chemical additive comprises a sulfonic acid compound;

a water soluble solvent; and

optionally

a biocide; and

pH adjusters;

wherein the chemical mechanical polishing composition has a pH of preferably 8 to 12.

2. The chemical mechanical polishing composition of claim 1, wherein the quaternary ammonium compound is chosen from the group consisting of ethyltrimethylammonium hydroxide (ETMAH), ethyltrimethylammonium bromide, ethyltrimethylammonium chloride, benzalkonium hydroxide, benzalkonium bromide, benzalkonium chloride, cetyltrimethylammonium hydroxide, cetyltrimethylammonium bromide (CTAB), cetyltrimethylammonium chloride, lauryltrimethylammonium hydroxide, lauryltrimethylammonium bromide, lauryltrimethylammonium chloride (LTAC), stearalkonium hydroxide, stearalkonium bromide, stearalkonium chloride, hexadecylpyridinium hydroxide, hexadecylpyridinium bromide, hexadecylpyridinium chloride (Cetylpyridinium chloride), poly(dimethyldiallylammonium hydroxide), poly(dimethyldiallylammonium bromide), poly(dimethyldiallylammonium chloride) (PDMDAAC), trimethylstearylammonium hydroxide, trimethylstearylammonium bromide, trimethylstearylammonium chloride, dimethyldioctadecylammonium hydroxide, dimethyldioctadecylammonium bromide, dimethyldioctadecylammonium chloride, tetraalkylammonium hydroxides, tetraalkylammonium bromides, tetraalkylammonium chlorides, tetramethylammonium hydroxide (TMAH), tetramethylammonium bromide, tetramethylammonium chloride, tetraethylammonium hydroxide, tetraethylammonium bromide, tetraethylammonium chloride,

tetrapropylammonium hydroxide, tetrapropylammonium bromide, tetrapropylammonium chloride, tetrabutylammonium hydroxide, tetrabutylammonium bromide, tetrabutylammonium chloride, ethyltrimethylammonium hydroxide, ethyltrimethylammonium bromide, ethyltrimethylammonium chloride, diethyldimethylammonium hydroxide, diethyldimethylammonium bromide, diethyldimethylammonium chloride, methyltriethylammonium hydroxide, methyltriethylammonium bromide, methyltriethylammonium chloride, choline hydroxide, choline bromide, choline chloride, choline bicarbonate, choline bitartrate, and other choline salts.

3. The chemical mechanical polishing composition of claim 1, wherein the second chemical additive is chosen from the group consisting of methanesulfonic acid (MSA), benzenesulfonic acid (BSA), toluenesulfonic acid, p-toluenesulfonic acid, 2-naphthalenesulfonic acid, naphthalene-1-sulfonic acid, dodecylbenzenesulfonic acid (DDBSA), camphorsulfonic acid, lignosulfonic acid, and poly(styrenesulfonic acid) (PSSA), ethane disulfonic acid, naphthalene - 2 - sulfonic acid, naphthalene disulfonic acid.

4. The chemical mechanical polishing composition of claim 2, wherein the first chemical additive comprises ethyltrimethylammonium hydroxide.

5. The chemical mechanical polishing composition of claim 3, wherein the second chemical additive comprises benzenesulfonic acid.

6. The chemical mechanical polishing composition of claim 1, further comprising an amino acid.

7. The chemical mechanical polishing composition of claim 6, wherein the amino acid is glycine.

8. The chemical mechanical polishing composition of claim 1, wherein the first chemical additive comprises ethyltrimethylammonium hydroxide, and the second chemical additive comprises benzenesulfonic acid.

9. The chemical mechanical polishing composition of claim 1, wherein a ratio of the first chemical additive to the second chemical additive is between about 4:1 and about 1:4.

10. A method of chemical mechanical polishing (CMP) a semiconductor substrate having at least one surface comprising a film containing polysilicon and silicon nitride, comprising:

providing the semiconductor substrate;

providing a polishing pad;

providing the chemical mechanical polishing (CMP) composition of claim 1;

contacting the surface of the semiconductor substrate with the polishing pad and the chemical mechanical polishing composition; and

polishing the least one surface.

11. The method of claim 10, wherein a selectivity of polysilicon removal rate to silicon nitride removal rate is greater than about 50.

12. The method of claim 10, wherein a removal rate of polysilicon is greater than about 5000 Å/min.

13. A system of chemical mechanical polishing (CMP) a semiconductor substrate having at least one surface comprising a film containing polysilicon, comprising:

a. the semiconductor substrate;

b. the chemical mechanical polishing (CMP) composition of claim 1; and

c. a polishing pad;

wherein the at least one surface comprising polysilicon is in contact with the polishing pad and the chemical mechanical polishing composition.

14. The system of claim 13, wherein the semiconductor substrate further comprises a silicon oxide film, wherein the silicon oxide film is selected from the group consisting of Chemical vapor deposition (CVD), Plasma Enhance CVD (PECVD), High Density Deposition CVD(HDP), or spin on silicon oxide film.

15. The system of claim 13, wherein the semiconductor substrate further comprises a silicon nitride film.

16. The system of claim 15, wherein a selectivity of polysilicon removal rate to silicon nitride removal rate is greater than about 50.