

Claims

1. A chemical mechanical planarization (CMP) composition comprising:

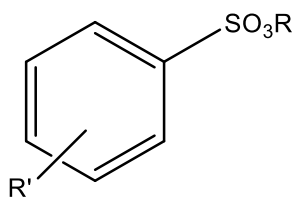
- a. 0.05 to 10 weight percent of an abrasive selected from the group consisting of ceria-coated inorganic oxides, ceria coated organic polymer particles, and combinations thereof.
- b. 0.005 to 1.0 weight percent of a first additive selected from the group consisting of maltitol, lactitol, maltotritol, D-sorbitol, mannitol, dulcitol, D-(-)-fructose, beta-lactose, and combinations thereof;
- c. a second additive consisting of an aromatic organic compound comprising sulfonate or sulfonic acid functional groups;
- d. a solvent selected from the group consisting of water, ethers and alcohols; and optionally
- e. a biocide and a pH adjuster;

wherein the composition comprises a pH ranging from 3 to 10.

2. The CMP composition of claim 1, wherein the abrasive is a ceria-coated inorganic oxide selected from the group consisting of: ceria-coated colloidal silica; ceria-coated high purity colloidal silica; ceria-coated alumina; ceria-coated titania; ceria-coated zirconia; and combinations thereof.

3. The CMP composition of claim 1, wherein the aromatic organic compound comprising sulfonate or sulfonic acid functional groups comprises sulfonate or sulfonic acid functional groups directly bonded to aromatic rings or linked to aromatic rings through alkyl bridging groups.

4. The CMP composition of claim 1, wherein the second additive has a general molecular structure:



wherein R is selected from the group comprising hydrogen, a sodium ion, a potassium ion and an ammonium ion; and R' is an alkyl group connected at alpha, meta, or para-positions relative to the sulfonic acid or sulfonate group, and comprising a structure of $\text{C}_n\text{H}_{2n+1}$ wherein n is selected from 1 through 18.

5. The CMP composition of claim 4, wherein the second additive is selected from the group consisting of: 4-dodecylbenzenesulfonic acid or its ammonium, sodium or potassium salt; 4-methylbenzene sulfonic acid or its ammonium, sodium or potassium salt; and combinations thereof.
6. A method of chemical mechanical polishing (CMP) a semiconductor substrate having at least one surface comprising a silicon oxide film, comprising:
 - a. contacting the at least one surface comprising a silicon oxide with a CMP polishing pad and the CMP composition of claim 1; and
 - b. polishing the least one surface comprising silicon dioxide.
7. The method of claim 6; 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), and spin on silicon oxide film.
8. The method of claim 7, wherein the silicon oxide film is SiO_2 film.
9. The method of claim 8; wherein the semiconductor substrate further comprises a silicon nitride surface; and the step (b) comprises polishing the least one surface comprising silicon dioxide at a removal selectivity of silicon oxide: silicon nitride greater than 60.