Role of Oxidizer and Inhibitor on Chemical Mechanical Planarization of Copper

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In order to meet the current demand of the interconnect technology to produce sub-micron range and multilevel metallization, it is highly important to study of the chemical mechanical planarization (CMP) of copper. The present work reports the role of oxidizer and inhibitor on the oxidation, dissolution and surface modification during Cu-CMP. Cu-CMP study was carried out combining electrochemistry, and removal rate measurements using hydrogen peroxide and glycine as an oxidizer and an inhibitor, respectively. X-ray photoelectron spectroscopy study was done to understand the interaction of $Cu-H_{2}O_{2}$-glycine complex formation during CMP. Changes in the surface morphology during the CMP process was investigated with the help of atomic force microscopy. In the presence of 0.1M glycine, copper removal rate was found to be high in the solution containing 2.5 percent $H_{2}O_{2}$ atpH 4 because of Cu^{2+}-glycine complexation reaction. In the absence of glycine, the removal rate of copper decreased with increasing $H_{2}O_{2}$ concentration due to the formation of a less soluble copper oxide film. The study revealed the mechanism of Cu surface alteration in the presence of oxidizers and glycine for formulation of highly effective CMP-slurry.