E-5

Organic additive effects in physical and electrical properties of electroplated Cu thin film

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Cu has been used for metallic interconnects in ULSI applications because of its lower resistivity according to the scaling down of semiconductor devices. The resistivity of Cu lines will affect the RC delay and will limit signal propagation in integrated circuits. In this study, we investigated the characteristics of electroplated Cu films according to the variation of concentration of organic additives. The plating electrolyte composed of $CuSO_4 \cdot 5H_2O$, H_2SO_4 and HCl, was fixed. The sheet resistance was measured with a four-point probe and the material properties were investigated with XRD (X-ray Diffraction), AFM (Atomic Force Microscope), FE-SEM (Field Emission Scanning Electron Microscope) and XPS (X-ray Photoelectron Spectroscopy). From these experimental results, we found that the organic additives play an important role in formation of Cu film with lower resistivity by EPD

Keywords: Copper, electroplating, organic additives

E-6

Effects of Dysprosium and Thulium addition on microstructure and electric properties of co-doped $BaTiO_3$ for MLCCs

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The effect of additives as rare-earth in dielectric materials has been studied to meet the development trend in electronics on the miniaturization with increasing the capacitance of MLCCs (multi-layered ceramic capacitors). It was reported that the addition of rare-earth oxides in dielectrics would contribute to enhance dielectric properties and high temperature stability. Especially, dysprosium and thulium are well known to the representative elements functioned as selective substitution in barium titanate with perovskite structure. The effects of these additives on microstructure and electric properties were studied. The 0.8 mol% Dy doped $BaTiO_3$ and the 1.0 mol% Tm doped $BaTiO_3$ had the highest electric properties as optimized composition, respectively. According to the increase of rare-earth contents, the growth of abnormal grains was suppressed and pyrochlore phase was formed in more than solubility limits.

Furthermore, the effect of two rare-earth elements co-doped $BaTiO_3$ on the dielectric properties and insulation resistance was investigated with different concentration. The dielectric specimens with $BaTiO_3$-Dy_2O_3-$Tm2O_3$ system were prepared by design of experiment for improving the electric properties and sintered at 1320℃ for 2h in a reducing atmosphere. The dielectric properties were evaluated from -55 to 125℃ (at 1KHz±10% and 1.0±0.2V) and the insulation resistance was examined at 16V for 2 min. The morphology and crystallinity of the specimens were determined by microstructural and phase analysis.

Keywords: Dielectric, BaTiO3,co-doped, Dysprosium, Thulium