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# Development of nanotwins in electroplated copper and its effect on shear strength of tin/copper joint

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## Abstract

Cost-effective copper (Cu) electroplating is the primary technique used to fabricate wires/interconnects in microelectronics. Grain microstructure and impurity incorporation in electroplated Cu plays an important role in its mechanical, electrical, and thermal properties. In this study, a specific plating formula with a basic electrolyte and a suppressor, polyethylene glycol (PEG) and chloride ion ($Cl^-$), is used to fabricate the Cu layers. An adjustment of plating current density dramatically alters the grain microstructure and impurity incorporation in the electroplated Cu. Scanning electron microscopy (SEM) and coincidence site lattice (CSL) analyses show that the Cu deposit plated at a low current density (< 0.43 $A/dm^2$) exhibits a lamellar nanotwinning structure with a large fraction of $\Sigma 3$ (60° rotation at 〈111〉) twin boundary. Time-of-flight secondary ion mass spectrometer (TOF-SIMS) analysis shows that the impurity incorporation level in electroplated Cu is significantly