

ELECTRICAL AND STRUCTURAL INVESTIGATION OF THE EFFECTS OF VIA-CONDUCTOR GEOMETRY IN THE ELECTROMIGRATION OF AL:CU.

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ABSTRACT

Electromigration (EM) experiments conducted using two types of via/plug to conductor alignment indicate a geometrical dependence of electromigration failure in Al:Cu conductors. The resistance vs time curves show distinctive steps when the alignment is parallel. This is explained by a successive loss of conductivity through the tungsten plug (0.5 microns wide) due to void formation at the W/Al:Cu interface. These changes in electrical properties are correlated with microstructure using cross-sectional micrographs in the two different via geometries. In the perpendicular via/conductor arrangement, resistance increases by smaller and closely spaced steps. EM experiments without vias, found that the conductor lifetime under high temperature and current stressing increases by at least an order of magnitude. Kinetic studies at four temperatures between 180-240°C found activation energies to be $1.0 \pm 0.1\text{eV}$. Results from EM experiments performed at different current densities will also be presented.