

# Electromigration Issues in State-of-the Art and Emerging Metallization Systems

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## ABSTRACT

Electromigration (EM) experiments conducted using different types of via/plug - conductor alignment indicate a geometrical dependence of electromigration failure in Al:Cu conductors. Resistances vs. time curves show distinctive steps when the alignment is parallel. This is explained by a successive loss of conductivity trough due to void formation at the W/Al:Cu interface of the tungsten plug (0.5 microns wide). The log-normal failure distribution plots also shows a strong dependence on structure type. These changes in electrical properties are correlated with microstructure using cross-sectional micrographs. 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  $0.7 \pm 0.1$  eV. Results from EM experiments performed at different current densities will also be presented. Preliminary EM results for other materials (Cu and Au) allow some interesting comparisons, which will be included.