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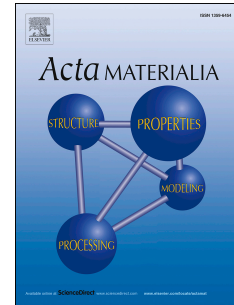
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Irregular bending growth of free-standing Al microwire by electromigration

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Abstract

Electromigration (EM) can generate free-standing micro- and nanowires that are occasionally irregularly bent to kinked and curved or collapsed shapes. The mechanism behind irregular bending was discussed based on electron microscopy data. Al microwires with the bamboo structure or single crystals were kinked at the grain boundaries (GBs) or at locations without GBs, respectively. Dislocation network and clusters of oxidation products were found in the wires. The kinking mechanism was attributed to the changing growth direction owing to GBs and the different growth rate of the outer circumference of the wire owing to the friction between the clusters and the TiN passivation. No buckling owing to gravity was observed. The high growth rate of Al microwires would be accompanied by low resistance in the discharge through a hole, which is attributed to the uniform friction along the periphery of the hole. In addition, the low wire diameter minimized the differences in growth rate. Hence, the increase in the growth rate of the wire by increasing the input current and substrate temperature and the decrease in the wire diameter favor wire straightness.

Keywords: Microwire, Electromigration, Aluminum, Kink, Grain boundaries

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