Through-mask Electrodeposition of Au Alloys

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Most through-mask plating associated with the "LIGA" process (the German acronym for Lithographie, Galvanformung, & Abformung) involves Ni plating.[1] For certain applications, the material properties of Ni may be inadequate. Gold and its alloys are often employed when a low contact resistance is important in the function of a device. Co and Ni, often alloyed with Au for hardness (desirable for components formed from this process), can diffuse to the surface and raise contact resistance if these alloys are heated.[2] Because of this problem, an electrodeposited Au-Cu alloy reported to have good strength and a low, stable contact resistance was investigated.[2-3]

The open points in Figure 1 show the steady state polarization behavior of an electrolyte based on salts of potassium gold cyanide and cupric EDTA at 65 ± 1°C.[2] The solid points are from a second bath identical to the first except that no Au salt was added to the electrolyte. A rotating Pt-disk electrode was used, and potentials are relative to a saturated calomel electrode. Apparently the plateau is associated with the mass-transport-limited consumption of Au ions; bright, gold-colored deposits were obtained below this plateau, whereas films obtained at higher current densities appear to be composed of mainly copper.

The difficulties of through-mask alloy plating will be discussed, as well as the microstructure, contact resistance, and annealing behavior of Au-Cu alloys from this bath. Gold hardened with Co and Ni will be used as reference for comparison. The annealing behavior is of particular interest since the Au-Cu system may undergo an order-disorder phase transformation.[4] Finally, mechanical tensile-test data from through-mask plated test samples will be presented.

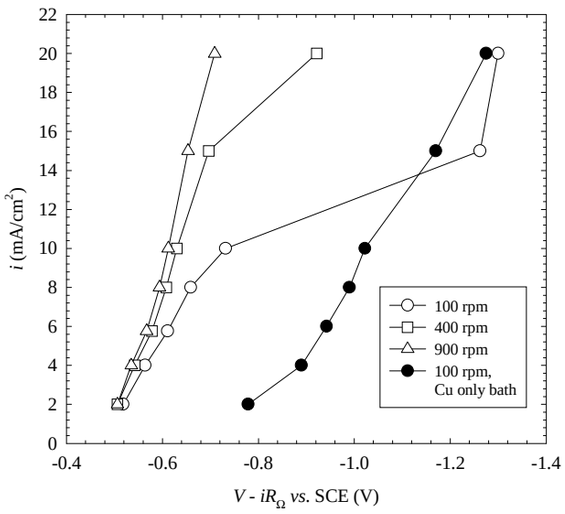

Figure 1. Steady-state polarization curves on a rotating disk electrode. Open points indicate an electrolyte having 20 and 40 mM $KAu(CN)_2$ and Cu EDTA, respectively. Solid points represent an electrolyte with Cu only. Curves are corrected for ohmic drop.

REFERENCES

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