Tailoring gold plating for thermal-compression bonding

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Gold for electronics or other applications can be obtained by controlling the structure by metal additions into the electrolyte and also by electrodeposition with very short current pulses and long off times. Soft gold is obtained from baths containing a small quantity of thallium ions as an additive, while hard gold is obtained from similar baths with nickel ions as an alternative additive. By referring to the normality inertia electrokinetic behavior of the elements in aqueous solutions, it is shown that normal metal ions addition give soft gold deposits, while inert metal addition give hard gold layers. The main influence of normal metal addition is a decrease in the cathodic voltage during deposition, with decrease in inhibition condition coming from complexant interaction with the cathodic surface. A similar effect can be obtained with pulsed current, when the voltage increase is limited, favouring the capacitance charging with respect to the faradaic discharge. In these conditions, lateral growth prevails with respect to outgrowth, which becomes predominant in inhibition conditions. Cyanide and sulphite gold baths show a similar behavior with respect to inhibition phenomena by complexant at surface.
In this presentation, the control of the process for gold plating in sulphite electrolyte is discussed, highlighting the effect of pulse plating on crystalline orientation and grain size, the role of additives on the roughness evolution and crystalline orientation, and the effects of the mechanical properties.