

Critical Barriers Associated with Copper Wire

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Abstract

The market potential for copper bonding wire is significant as IC and package designers look to reduce costs and address a number of significant interconnect challenges associated with copper bonding wire. Palladium Copper bonding wire was introduced to the industry back in 2008. Palladium copper bonding wire migration is cost savings, with secondary focus for performance and reliability improvement. The critical barriers in fine pad pitch applications associated with bare copper wire such as 2nd bond instability (NSOL), short tails, limited shelf/bonder life (wire oxidation) and high temperature/humidity reliability have been solved with the development of a Palladium coated copper bonding wire. As a result of the maturity of Palladium copper wire, some process and design limitations have been confirmed such as harder FAB (free air ball), fine pitch process issues, capillary life and advanced bonding techniques. An improvement and solution is a silver bonding wire which has been introduced as an alternative wire to overcome the limitations of the copper wire.

The advantage of switching from copper wire to silver wire is that silver wire meets ball bonding performance requirements, soft FAB and comparable loop formations while maintaining productivity requirements of other alternative bonding wires. Silver bonding wire has good elongation and breaking load properties and silver wire is ductile like gold wire with non existent 'work-hardening' process issues like copper wire.

It is relatively easy to switch from gold wire and copper wire since silver wire only requires safe and inexpensive nitrogen gas. Also silver wire has similar level of productivity as gold wire and sufficient second bond adhesion under almost the bonding conditions as gold wire. Silver wire shows good potential as it offers several advantages compared to bare copper and palladium coated copper wires; mainly, acceptable bonding performance and reliability.

Silver may not work for all applications but it can certainly help support many application areas where cost and performance define a product. Silver wire usage is expected to increase in the next few years in both the LED and semiconductor industry.