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Low temperature sintering silver nanoparticle for pressure-less die attachment

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Die attachment is one of the most important processes in the packaging of power semiconductor devices. Sintered silver has demonstrated superior properties in microelectronic packaging as compared to the traditional solders and conductive epoxies. The sintering joints formed by atomic diffusion of silver nanoparticle can be processed at a temperature significantly lower than the melting temperature of the bulk and can be used for high temperature applications. The potential advantages such as high temperature stability, high electrical and thermal conductivity, good mechanical properties etc. makes silver nanoparticle a promising candidate for die-attach applications. In the present invention, we have synthesized capped silver nanoparticle and nanosilver paste which can be used for pressure-less die attach applications. The percentage of capping according to thermo-gravimetric analysis is around 1%. TEM reveals the size of the silver nanoparticle to be around 3 nm to 80 nm. The heterogeneous particle sizes help in sintering of the nanoparticle at a faster rate because of their large point of contact between each other which also leads to good packing fraction. The die attach paste made from these heterogeneous size silver nanoparticles is used for pressure-less die attach applications on different metallized substrate (Au, Ag and Cu) to achieve a joint strength of 25-30 MPa when sintered at 180°C for 60 minutes. The thermal conductivity of the sintered material was around 200 W/m.K. The above results clearly show that the nanosilver paste sintered at lower temperature has a slight edge over the traditional solder and conductive epoxies.

Biography

Shamik Ghosal has completed his PhD from Bhabha Atomic Research Centre, India and Postdoctoral studies from University of Leipzig, Germany. Presently, he is working as a Manager in MacDermid Performance Solutions and has published more than 15 papers in reputed journals.

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