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Effect of Zn nanoparticle-doped flux on mechanical properties of SAC305 solder joint after electromigration

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ABSTRACT

Migration of Cu atoms from the cathode side to the anode side causes void formation in the solder joint, which is the root cause of electromigration failures in lead-free solder joints. This study investigates the effects of Zn nanoparticle-doped flux on the mechanical properties of SAC305 solder joint under high current density. Nanoparticle-doped flux is a novel technique which mainly focused to modify the interfaces of the solder joint. Since, electromigration mainly damages the interfaces of the solder joint, so nanoparticle-doped flux technique was used to retard the electromigration damages. Electromigration test was conducted under the current density of 1×10^4 A/cm^2. The electromigration test was conducted in the silicon oil bath at a maintained temperature of 80 ± 5 °C. Tensile test was conducted before and after electromigration tests for undoped and Zn nanoparticle-doped solder joints. The results showed that the mechanical strength improved after the addition of Zn nanoparticle-doped flux before and after electromigration as compared to the undoped SAC305 solder joint. The Cu migration was suppressed by Zn nanoparticle doped due to which the fractured path was not shifted from the solder bulk to the cathode side. In comparison, the undoped solder showed rapid Cu migration due to which the fracture path shifted from solder bulk to cathode interface.

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