

Wettability, electrical and mechanical properties of 99.3Sn-0.7Cu/Si₃N₄ novel lead-free nanocomposite solder

Abstract

A nanocomposite solder alloy with 99.3Sn-0.7Cu base alloy was successfully fabricated using the powder metallurgy route which consists of blending, compaction and sintering. Varying amount of nano size silicon nitride particulates were introduced as reinforcements to obtain a novel lead-free nanocomposite solder alloy. Following fabrication, the sintered nanocomposite solder were cut into thin solder disc and were analyzed in terms of their wettability, electrical and mechanical properties. Wettability, electrical and mechanical properties of the nanocomposite solder were compared to 99.3Sn-0.7Cu and 96.3Sn-3.0Ag-0.5Cu lead-free solder which were fabricated with the same method using powder metallurgy route. Wettability property of the nanocomposite solder was found to be in the accepted range with wettability angle below 45° similar to 99.3Sn-0.7Cu and 96.3Sn-3.0Ag-0.5Cu lead-free solder. Besides wettability, the results of electrical and mechanical properties analysis showed that additions of nano size Si₃N₄ had enhanced the strength and electrical conductivity of nanocomposite solder comparing to 99.3Sn- 0.7Cu and 96.3Sn-3.0Ag-0.5Cu lead-free solder.