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Microstructure Evolution of Sn-3.5Ag-1.0Cu-0.5Ni/Cu System Lead Free Solder under Long Term Thermal Aging

Abstract

Due to environmental concerns, lead-free solders were introduced in replacing the lead-based solders in microelectronics devices technology. Although there are many lead-free solder available, the Sn-Ag-Cu solder was considered the best choice. But the solder has its draw backs in terms of melting temperature and intermetallic formations. In this study, the effect of 0.5wt% Ni addition on the microstructure of the Sn-3.5Ag-1.0Cu solder was investigated. The solder was synthesized via powder metallurgy route which includes blending, compacting and sintering. The solders were characterized for its densities and melting temperatures. SEM was used to observe the microstructure of intermetallic phases. The solders were melted on copper substrate at 250°C for one minute and aged at 150°C from 0 to 400 hours. The phases formed were studied under SEM. The SEM results showed the presence of Cu_6Sn_5, Cu_3Sn, Ag_3Sn and $(Cu,Ni)_6Sn_5$ intermetallics.

Keywords: Intermetallic, Powder Metallurgy, Scanning Electron Microscope (SEM), Sn-Ag-Cu-Ni, Thermal Aging