

Thermal cyclic test for Sn-4Ag-0.5Cu solders on high P Ni/Au and Ni/Pd/Au surface finishes

ABSTRACT

In electronic packaging, the reliability of the interconnection changes with the surface finish and the type of solders being used. Thermal cycling is one method of reliability assessment. In thermal cycling experiments, the strain state is simplified by soldering together regular shaped pieces of materials with different coefficients of thermal expansion and exposing the joint to repeated fluctuations of temperature within a certain range. Thus, this study focuses on the intermetallic evolution of Sn-4Ag-0.5Cu on Ni/Au and Ni/Pd/Au surface finishes with thermal cycling up to 1000 cycles with the range of temperature varying from 10 to 80°C. Sandwich samples were prepared by placing solder balls of Sn-4Ag-0.5Cu between two substrates of two different surface finishes: Ni/Au and Ni/Pd/Au. Optical microscope and FESEM (Field emission scanning electron microscope) were used to analyze the samples. From the study, it was observed that the intermetallic changes from (Cu, Ni)₆Sn₅ to (Ni, Cu)₃Sn₄ after 1000 thermal cycles for Ni/Au. These changes promote the formation of cracks at the solder joint because of the different mechanical properties between Ni-Sn based intermetallic and Cu-Sn intermetallics. However, for the Ni/Pd/Au surface finishes, no cracks formed after thermal cycling up to 1000 cycles. This shows that the reliability of the solder joint is higher for Ni/Pd/Au surface finishes in this experiment. Based on these results, it can be concluded that the reliability of the Ni/Pd/Au surface finishes with Sn-4Ag-0.5Cu solders is higher within the given condition of this research.

Keyword: Ni/Au; Ni/Pd/Au; Lead free solders; Thermal cyclic test; Sn-4Ag-0.5Cu