

Effects of vanadium on the properties of Sn-3wt%Ag-5wt%Cu solder alloy

Abstract

The present study explores the effects of minor vanadium (V) addition on Sn-3wt%Ag-5wt%Cu (SAC35) based solder alloy. Weight percentages of V ranging from 0 to 0.15 wt% were investigated. The objective was to study the influence of V on the microstructure, thermal, and mechanical properties of the SAC35 solder alloy. A notable change was observed with the addition of V. The addition of V led to the refinement and enhanced uniformity of the grain size of the intermetallic compounds (IMCs). Furthermore, the IMC thickness at the interface between the solder and Cu substrate was reduced with increasing amounts of V. During solidification, the cooling curve revealed a noteworthy increase in the recalescence value from 10.9 to 13.9 °C after the addition of 0.15wt% V. This indicates that the addition of V might influence the solidification behaviour of the SAC35 solder alloy. Moreover, the undercooling values demonstrated a decreasing trend with the amounts of V increases. This implies that the nucleation process of the SAC35 was facilitated by V addition, resulting in a finer microstructure. The ball shear test demonstrated that the SAC35-xV/Cu solder joints positively impacted the shear strength and ductility by V addition. Overall results showed that the properties of V-alloyed SAC35 solder alloy were improved.