

Structural, thermal and mechanical properties of gallium-enriched SAC lead-free solders

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The most promising lead-free solders are SnAgCu (SAC) [1,2]. Although a lot of work has been done in this area in recent years, properties of these solders have not yet been fully optimized, especially in relation to previously used lead-based solders [3]. In order to improve the properties of lead-free solders, additional alloying elements can be introduced [4]. The aim of this work is to study the effect of Ga addition on structural, thermal and mechanical properties of SAC. In the experimental investigation, scanning electron microscopy, energy-dispersive X-ray spectroscopy, X-ray diffraction, differential scanning calorimetry and Vickers hardness testing were used. It was found that the microstructure of the SAC solder contains three types of phases - (Sn), Ag-rich and Cu-rich. If gallium is added, the phase composition and morphology starts to differ. Besides that, the melting point decreases. The Vickers hardness was found to increase with increasing Ga content. Experimental results were then compared to calculations obtained using the Thermo-Calc software.

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