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Thermal Expansion Behavior of the Electroless Copper Coated Cu-SiC_p Composites Fabricated via the Conventional Powder Metallurgical Technique

Abstract

The introduction of the metal matrix composites as the advanced electronic packaging materials is highly anticipated because their thermal properties can be engineered to match those of semiconductors, ceramics substrates and optical fibers. Among these advanced packaging materials, silicon carbide particles reinforced copper matrix (Cu-SiC_p) composites are highly rated due to the high thermal conductivity of copper and low coefficient of thermal expansion (CTE) of silicon carbide. However, the Cu-SiC_p composites fabricated via the conventional powder metallurgy (PM) technique usually have immature thermophysical properties due to the weak bonding between the copper matrix and the SiC_p reinforcement. In order to improve the bonding between the two constituents, the SiC_p were coated with copper via electroless coating process prior to PM fabrication processes. Based on the experimental results, The CTE and porosity of the Cu-SiC_p composites were significantly affected by the volume fraction of SiC_p. Furthermore, the CTE and porosity of the Cu-Coated Cu-SiC_p composites were significantly lower than the non-Coated Cu-SiC_p composites. These differences were mainly contributed by the nature of the bonding between the copper matrix and SiC_p reinforcement.

Keywords; Copper Matrix Composites, Electroless Copper, Silicon Carbide Particles, Thermal Expansion