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The outcome of sintering parameters study toward the thermal properties of CuSiC composite

Abstract

Miniaturisation of electronic chips which have increasing functionality within the same package size has induced significant increases in requirements for extraction of heat from the integrated circuit (IC). Packaging materials therefore have to be capable to conduct heat efficiently and at the same time have low coefficient of thermal expansion (CTE) to minimize the thermal stress and warping. In the present study, copper silicon carbide was selected with an aim to solve thermal management problem presented by current IC systems. Powder metallurgy routes were chosen to fabricate the MMC based on this materials system. Copper and silicon carbide powders were mixed together in a planetary ball mill, and the green articles were then compacted and sintered to produce the final product of CuSiC. The sintering parameters were investigated for their effects towards the thermal conductivity of the composite. Sintering parameters investigated included temperature, heating duration and the gaseous environment. Upon sintering, the CuSiC particle bond to one another giving a higher strength and a possibility in attaining desirable density. Thus to achieve good thermal conductivity, the recommended sintering parameter suggests that the CuSiC composite should be sintered at 950°C for 7 hours in nitrogen gas.

Keywords; Coefficient of Thermal Expansion, Copper, Copper Silicon Carbide, Electronic Chips, Integrated Circuit, Metal Matrix Composite (MMC), Packaging Materials, Powder Metallurgy, Silicon Carbide (SiC), Sintering, Thermal Conductivity (TC)