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Solid-liquid co-existent phase process: towards fully dense and thermally efficient Cu/C composite materials

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ABSTRACT:

Metal matrix composites are currently being investigated for thermal management applications. In the case of a copper/carbon (Cu/C) composite system, a particular issue is the lack of affinity between the Cu matrix and the C reinforcements. Titanium-alloyed Cu (Cu-Ti) powders were introduced in a Cu/C powder mixture and sintered under load at a temperature at which the Cu-Ti powders became liquid, while the rest of the Cu and C remained solid. Fully dense materials were obtained (porosity of less than 5%). The creation of regular and homogeneous interphases was confirmed. All Ti reacted with the carbon, hence purifying the Cu matrix. Thermal conductivities were enhanced as compared with the Cu/C composites without interphase. The chemical analyses are in agreement with thermodynamic simulations carried out to predict the phase transformation during the sintering process.

KEYWORDS: metal matrix composites, solid-liquid co-existent phase process, heat conduction, CALPHAD