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Elaborating the Cu-network structured of the W–Cu composites by sintering intermittently electroplated core-shell powders

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Abstract

The tungsten–copper composites are widely used in heat sink materials for high power circuits, electrical contact materials, and electrode materials because of their excellent thermal and mechanical properties. We elaborate the Cu-network structured of the W–Cu composites by sintering the intermittently electroplated core-shell powder. After hot-pressing sintering, the W particles dispersed uniformly within the continuous Cu phase. Thus, the bulk of the dense W–Cu composites demonstrated the desired Cu-network structure with high thermal conductivity. No distinct voids were found in the connection between W and Cu. Thermal conductivity increased with the increase of Cu content, and the maximum value was 274.23 W/(m·K). The high sintering density, the Cu-network structure, and the good interface of W and Cu are the main factors ensuring the excellent thermal performance of composites. The maximum values of bending strength (995 MPa) and hardness (240 HV) were achieved with the 20 wt. % Cu sample. The deposition process of Cu coating during intermittent electroplating was also discussed.

Keywords: heat sink materials, W–Cu composites, core-shell particle, Cu-network