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Effect of ball-milling and graphene contents on the mechanical properties and fracture mechanisms of graphene nanosheets reinforced copper matrix composites

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Abstract

Graphene nanosheets (GNSs) reinforced pure copper matrix composites were prepared by ball-milling and hot-press sintering. The morphologies and structures of GNSs-Cu powders were studied after ball-milling for different time. The effects of the GNSs content on the microstructures, mechanical properties and fracture mechanisms of the composites were also investigated. It is indicated that the GNSs are gradually dispersed into the copper matrix with increasing the ball-milling time and a uniform dispersion is achieved after ball-milling for 5 h. When the content of GNSs in the composite is 0.5 wt.%, GNSs distribute randomly in the composite and the interface bonding is good which is benefit to enhance the mechanical properties of composite. With increasing the GNSs contents, the aggregation of GNSs in the composite is apparent, which seriously separates the matrix and results in low mechanical properties. The fracture mechanism of the composites changes from ductile to brittle.

Keywords: A. Mechanical characterization; B. Composites; C. Powder metallurgy; D. Fracture; D. Interfaces.