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Preparation of graphene nanoplatelets-copper composites by a modified semi-powder method and their mechanical properties

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Abstract

A modified semi-powder method was adopted to fabricate graphene nanoplatelets (GNPs)-copper composites in the present study. Electroless Cu and Ni plating were firstly performed on the surface of GNPs before semi-powder mixing to improve wettability of GNPs. The main structure of GNPs was maintained after the plating process. Microstructure studies showed both of 0.5 vol.% copper-plated and nickel-plated GNPs (Cu-GNPs and Ni-GNPs) were uniformly distributed and well bonded with the Cu matrix. The electroless plating improved the mutual disperse of GNPs and the Cu matrix. Compared with pure Cu, composites with addition of 0.5% Cu-GNPs exhibited an increase of 49.1% in yield strength. Benefiting from better dispersion and stronger interfacial bonding, the increase of 64.5% in yield strength was obtained in 0.5% Ni-GNPs/Cu composite. The strengthening mechanisms, including grain refinement, thermal mismatch and load transfer were carefully discussed.

Keywords: Graphene nanoplatelets; Cu matrix composites; Semi-powder method; Mechanical properties; Strengthening mechanisms

Introduction

Copper matrix composites have generated considerable interests owing to their distinguished mechanical and physical properties, including high tensile strength, high Young's modulus, excellent wear resistance and good thermal conductivity [1-3]. With the development of material science, novel materials with unique mechanical