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Simultaneous achievement of high strength, excellent ductility, and good electrical conductivity in carbon nanotube/copper composites

Ping Yang¹, Xin You^{1,2,*}, Jianhong Yi^{1,2,*}, Dong Fang¹, Rui Bao¹, Tao Shen¹, Yichun Liu¹, Jingmei Tao¹, Caiju Li¹, Songlin Tan¹, Shengda Guo¹

1. Faculty of Materials Science and Engineering, Kunming University of Science and Technology, Kunming, 650093, China;

2. Key Laboratory of Advanced Materials of Yunnan Province, Kunming, 650093, China

*Corresponding author: nissalor@gmail.com (X. You), yijianhong2007@sohu.com (J. Yi)

Abstract

In this study, a novel mixing method that combines wet mixing and conventional ball milling followed by spark plasma sintering (SPS) was used to fabricate carbon nanotube (CNT)-reinforced Cu-matrix composites. The samples were characterized using scanning electron microscopy, transmission electron microscopy, Raman spectroscopy, and X-ray diffraction. In the CNT/Cu composites produced, the CNTs were uniformly dispersed whilst maintaining their integrity. Consequently, a combination of high strength, ductility, and electrical conductivity was achieved by a 2.5 vol% CNT/Cu composites (ultimate tensile strength 280 MPa, elongation 41.7%, and electrical conductivity (IACS%) 91.6%). These results could potentially be used to effectively ameliorate the issue of strength-ductility and strength-conductivity trade-offs in metal-matrix composites.

Keywords: Metal-matrix composites; Carbon nanotubes; Mechanical properties; Electrical properties.

1. Introduction

Copper is an attractive material that is used for a wide range of applications because of its excellent electrical and thermal conductivities and thermal stability. It is used in electronic devices and high-power facilities, as well as aerospace, transportation, and

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