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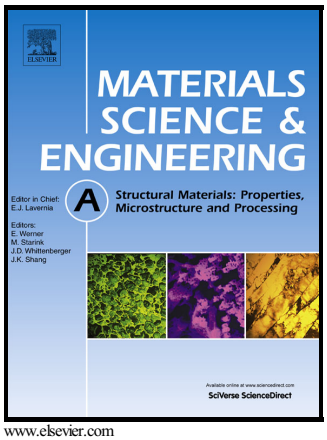

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Mechanical and thermal properties of reduced graphene oxide reinforced aluminum nitride ceramic composites

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Abstract:

High density reduced graphene oxide (rGO) reinforced aluminum nitride (AlN) composites were successfully fabricated by one-step spark plasma sintering (SPS) method. Raman spectra showed that the raw material of GO was thermal reduced to rGO during the SPS process, and the reduction of GO can be strongly affected by the carbonaceous atmosphere. With the rGO content increasing (0–2 wt.%), the dispersion of rGO and relative density of the composites decreased, made the elastic modulus and hardness decreased accordingly. Whereas the flexural strength had a slight increase when rGO content was ≤1 wt.%, and the fracture toughness increased from 3.5 to 5.2 MPa·$m^{1/2}$ with the rGO due to the crack bridging and pull out of rGO. The thermal conductivity of the composites was low and sharply decreased from 92.5 to 37.4 W·m^{-1}·K^{-1} with the addition of rGO, which are attributed to the low crystalline quality and high vacancy defects in rGO and the increase of interfacial thermal resistance.

Keywords: Reduced graphene oxide; Aluminum nitride; Mechanical properties; Thermal properties

1. Introduction

Graphene, as an allotrope of carbon consisting of a single layer of sp^2 bonded carbon atoms, has recently attracted tremendous attention due to its excellent mechanical, thermal, and electrical properties, such as high Young's modulus (1 TPa), high fracture strength (125 GPa), extreme thermal

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