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Fabrication of a polymer composite with high thermal conductivity based on sintered silicon nitride foam

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Abstract: A novel route was developed to fabricate Si₃N₄/epoxy composite. In this route, the Si₃N₄ particles were constructed into the foamed shape by using protein foaming method, firstly. Then the Si₃N₄ foams were sintered to bond these Si₃N₄ particles together. Finally, the Si₃N₄/epoxy composite was fabricated by infiltrating the epoxy resin solution into the sintered Si₃N₄ foams. This route was proved to be an efficient way in enhancing the thermal conductivity of epoxy matrix at a low loading fraction. For example, the thermal conductivity of the as-prepared Si₃N₄/epoxy composite with a loading fraction of 22.2vol% was up to 3.89 W·m⁻¹·K⁻¹, which was about 17 times higher than that of neat epoxy.

Keywords: A. Polymer-matrix composites (PMCs); A. 3-Dimensional reinforcement; B. Thermal properties; Silicon nitride foams.

1. Introduction

Heat dissipations made of polymer matrix composites (PMCs) with high thermal conductivity and excellent dielectric property are very important components in many high-density electronic devices, including central processing unites (CPUs), radio frequency (RF) unites, batteries and displays [1,2]. However, the intrinsic thermal conductivity of polymer is very low, for instance, the thermal conductivity of the widely used epoxy resin in these

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