Frontiers article

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A novel, eco-friendly technique for covalent functionalization of graphene nanoplatelets and the potential of their nanofluids for heat transfer applications

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ABSTRACT

In this study, a facile, economical and eco-friendly covalent functionalization technique is developed to synthesize highly stable graphene nanoplatelets (GNPs) in aqueous media. This technique involves free radical grafting of gallic acid onto the surface of GNPs rather than corrosive inorganic acids. Raman spectroscopy, X-ray photoelectron spectroscopy and transmission electron microscopy are used to confirm the covalent functionalization of GNPs with gallic acid (GAGNPs). The solubility of the GAGNPs in aqueous media is verified using zeta potential and UV-vis spectra measurements. The nanofluid shows significant improvement in thermo-physical properties, indicating its superb potential for various thermal applications.

Keywords

Green functionalization, Graphene nanoplatelets (GNPs), eco-friendly synthesis, Thermal conductivity, Nanofluids

1. Introduction

In the last decade, the potential applications of nanoparticle aqueous suspensions with high effective thermal conductivity have gained considerable attention among the scientific community. More recently, there is remarkable enhancement in the thermo-physical and heat transfer properties of carbon-based nanofluids [1-4]. Among various carbon-based nanostructures, graphene nanomaterials are of practical interest because of their favorable thermal, electrical and mechanical properties which can be exploited for various applications [5-10]. Graphene Nano platelets (GNPs) and nanofluids