

Synthesis of graphene-Fe magnetic nanofluid for enhancement of water thermal conductivity.

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Abstract

In recent years, using nanofluids to increase the heat transfer is gaining much more attention among engineers and researchers. Nanofluids are comprised of a concentration of nanoscale sized particles dispersed in a base fluid. Nanoparticles examples include pure metals, oxides, carbides, and carbon nanotubes. The base fluid can be any material from pure water, ionic liquids, oils, to diluted organic compounds such as ethylene glycol and oleic acid. Magnetic nanofluids also called as ferrofluids, consist of colloidal mixtures of super paramagnetic nanoparticles suspended in a nonmagnetic carrier fluid, constitute a special class of nanofluids exhibiting both magnetic and fluid properties. In these suspensions, also known as smart or functional fluids all features such as fluid flow, particles movement and heat transfer process can be controlled by applying external magnetic fields. In the present work, we proposed to synthesize water base nanofluids consisting of magnetic Graphene-Fe (MGF) nanocomposite and to study the fluid thermal conductivity in presence and in absence of magnetic field. Graphene was prepared by exfoliation method and graphene-Fe nanocomposite was prepared by co-precipitation of Fe₂O₃ (over graphene) from aqueous salt solution Fe (II) and Fe (III) in alkaline medium. Synthesis of nanofluid has been done by well dispersed of MGF in a certain fluid. The results obtained showed that, the dispersion of these nanoparticles in fluid as a magnetic nanoparticle increased the efficiency of nanofluid (when graphene is used alone) and a significant improvement in thermal conductivity has been obtained by addition Fe₃O₄ to graphene sheets. When the magnetic field is applied, the magnetic dipole moments of the particles align and the particles came in contact with each other and form chains in the direction of the applied magnetic field. When parallel to the direction of heat flow, the magnetic field causes the effective thermal conductivity in the direction of the magnetic field to increase. Characterization techniques like X-ray diffraction (XRD), Scanning electron microscope (SEM), FTIR and Raman shift spectroscopy were used to investigate the morphology and structure of synthesized nanoparticles, while thermal conductivity of nanofluid at different conditions is measured by thermal conductivity meters and temperature thermocouples readings.

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Biography

Prof. Dr. Mohammed Ibrahim has completed his PhD from University of Technology (1996) and his MSc degree from Glasgow University in UK (1985). He was the deputy dean of Chemical Engineering Department (University of Technology) between the year 2009-2013. He has been serving as teaching staff of nanotechnology and nanomaterial in

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