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

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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. The particles can be composed of any type of material, 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. A chance to increase the heat transfer by employing nanofluids have opened the way for a spectrum of promising applications like miniature electronic devices, high power electric devices like transformers and enhanced heat transfer in many other energy conversion systems. Magnetic nanofluids also called as ferrofluids, consists 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 (Ge-Fe) 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 Fe_2O_3 (over graphene) from aqueous salt solution in alkaline medium. Synthesis of nanofluid has been done by well dispersed of Ge-Fe in a certain fluid. The results obtained showed that, the disperssion of these nanoparticles in fluid, as a magnetic nanoparticle increased the efficiency of nanofluid (when graphene is used alone) and a significant improvment in thermal conductivity has been obtained by addition of Fe 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),Transmission electron microscope (TEM),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.

Biography

Mohammed İbrahim has completed his PhD at University of Technology (IRAQ) in Material Science on 1996 and he got his MSc degree from University of Glasgow (UK) in Reactor Technology (1985). He has published more than 40 scientific papers in material technology in scientific journals and has been serving as Researcher and Teaching Staff in University Of Technology/Chemical Engineering Department. Currently, he is working as an academic staff in Chemical Engineering Department, Faculty of Engineering,Sulyeman Demirel University-Isparta-Turkey.

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