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Study of Ultrasonic and Thermal Properties for Heat Transfer Enhancement in Fe_2O_3 Nanoparticles-Ethylene Glycol Nanofluids

Shakti Pratap Singh[1,2] · A. K. Verma[2] · A. K. Jaiswal[3] · Devraj Singh[2] · R. R. Yadav[1]

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Abstract

In present work, semiconducting iron (III) oxide (Fe_2O_3) nanoparticles have been synthesized by sol–gel method. X-ray diffraction (XRD), UV–Visible (UV–Vis) absorption spectroscopy and transmission electron microscopy (TEM) have been used for the characterization of the synthesized nanoparticles. Two-step technique was used to formulate stable ethylene glycol (EG) based Fe_2O_3 nanofluids at room temperature. Thermal conductivity of nanofluids has been measured using hot disc thermal constants analyzer. Significant enhancement in the thermal conductivity is noted at very low nanoparticle loading (up to 1 wt%). Ultrasonic velocity and ultrasonic attenuation in the prepared nanofluids were investigated using an ultrasonic interferometer and acoustic particle sizer (APS-100), respectively. APS-100 was also used for the analysis of particle size distribution (PSD) of Fe_2O_3 nanoparticles in the prepared nanofluids. The PSD result of APS-100 has been found in good agreement with that of TEM. The characteristics behaviour of Fe_2O_3 nanofluid has been illustrated based on its ultrasonic and thermal properties. Our investigations advocate that Fe_2O_3 nanofluids have potential application for effective heat transfer management in various cooling industries.

Keywords Fe_2O_3 nanoparticles · Nanofluids · Thermal conductivity · Ultrasonic attenuation spectroscopy · Ultrasonic velocity

✉ Shakti Pratap Singh
shaktisingh@allduniv.ac.in

[1] Department of Physics, University of Allahabad, Prayagraj 211002, India

[2] Department of Physics, Prof. Rajendra Singh (Rajju Bhaiya) Institute of Physical Sciences for Study and Research, V. B. S. Purvanchal University, Jaunpur 222003, India

[3] Department of Physics, H.N.B. Govt. P.G. College, Naini, Prayagraj 211008, India

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