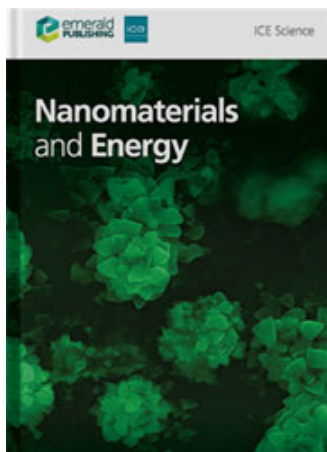


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Nanomaterials and Energy

ISSN 2045-9831 | E-ISSN 2045-984X

Volume 9 Issue 1, June 2020, pp. 8-13

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Preparation and characterisations of magnetic nanofluid of zinc ferrite for hyperthermia

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Published Online: June 26, 2020

Keywords: [magnetic materials](#) [material structure](#) [nanoparticles](#)[Open PDF](#)Key: [OA](#) Open access content [S](#) Subscribed content [F](#) Free content [T](#) Trial content

Abstract

Zinc ferrite (ZnFe_2O_4) nanoparticles were synthesised by using solution gelation and the self-combustion technique. The ferrite nanoparticles were structurally analysed by X-ray diffraction (XRD), field-emission scanning electron microscopy (FE-SEM) and vibrating sample magnetometry for structural, morphological and magnetic properties, respectively. The XRD pattern of the prepared sample has a spinel monophasic cubic structure, and the broadening of X-ray peaks indicates the nanocrystalline nature of the particles to be on the order of 13 nm. FE-SEM analysis shows spherical-type grains and confirms the nanocrystalline nature with an average grain size of 24 nm. The energy-dispersive X-ray analysis spectrum indicates the purity of the sample and the presence of the desired ions in good proportions. The magnetisation–field strength ($M-H$) hysteresis loop shows enhanced magnetisation and superparamagnetic nature of zinc ferrite nanoparticles compared with previous literature reports. The saturation magnetisation (M_s) was estimated to be 23–25 emu/g. The obtained nanoparticles of zinc ferrite were used to prepare nanofluids with water as the base fluid (2 mg/ml concentration). Magnetic hyperthermia studies were carried out using an induction heating system. The heating results show that a small amount (2 mg/ml) of zinc ferrite nanoparticles can achieve a 42°C temperature for 258 s.

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