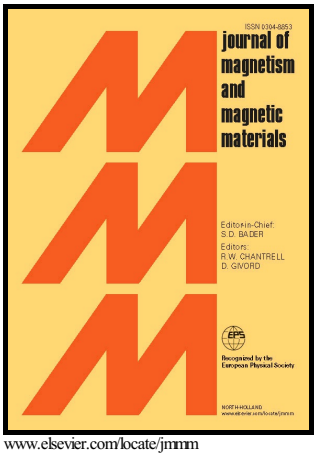

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Synthesis of high saturation magnetic iron oxide nanomaterials via low temperature hydrothermal method

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Abstract

Iron oxide nanoparticles (IONPs) were synthesized through a simple low temperature hydrothermal approach to obtain with high saturation magnetization properties. Two series of iron precursors (sulfates and chlorides) were used in synthesis process by varying the reaction temperature at a constant pH. The X-ray diffraction pattern indicates the inverse spinel structure of the synthesized IONPs. The Field emission scanning electron microscopy and high resolution transmission electron microscopy studies revealed that the particles prepared using iron sulfate were consisting a mixer of spherical (16 - 40 nm) and rod (diameter ~ 20-25 nm, length <100 nm) morphologies that synthesized at 130 ˚C, while the IONPs synthesized by iron chlorides are found to be well distributed spherical shapes with size range 5-20 nm. On other hand, the IONPs synthesized at reaction temperature of 190 ˚C has spherical (16 - 46 nm) morphology in both series. The band gap values of IONPs were calculated from the obtained optical absorption spectra of the samples. The IONPs synthesized using iron sulfate at temperature of 130 ˚C exhibited high saturation magnetization (M_S) of 103.017 emu/g and low remanant magnetization (M_r) of 0.22 emu/g with coercivity (H_c) of 70.9 Oe, which may be attributed to the smaller magnetic domains (d_m) and dead magnetic layer thickness (t).

Keywords: Magnetite; Hydrothermal synthesis; Nanoparticles; Band gap energy; Saturation magnetization.

1. Introduction

Magnetic nanoparticles have gained renewed interest mainly due to their promising applications in various fields such as magnetic recording media, sensors, spintronics, and biological applications including cell type