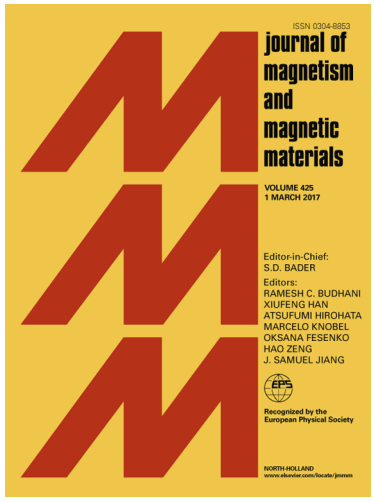

Research articles

Characterization and structural and magnetic studies of as-synthesized $Fe^{2+}Cr_{x}Fe_{(2-x)}O_4$ nanoparticles

M.A. Amer, A. Matsuda, G. Kawamura, R. El-Shater, T. Meaz, F. Fakhry

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Characterization and structural and magnetic studies of as-synthesized $Fe^{2+}Cr_xFe_{(2-x)}O_4$ nanoparticles

M.A. Amer [a,*], A. Matsuda[b], G. Kawamura[b], R. El-Shater [a], T. Meaz [a], F. Fakhry [a]

[a] Physics Department, Faculty of Science, Tanta University, Tanta 31527, Egypt

[b] Electrical and Electronic Information Engineering Department, Toyohashi University of Technology, Toyohashi 441-8580, Japan

Abstract

As-synthesized $Fe^{2+}Cr_xFe_{(2-x)}O_4$ nanoferrites, $0.0 \leq x \leq 1$, were prepared by the wet-chemical co-precipitation route and characterized by the X-ray diffraction, Brunauer-Emmett-Teller and transmission electron microscopy, IR spectra, thermographometry and vibrating sample magnetometry (VSM) techniques. This study proved that these samples have single phase of cubic spinel structure in nano-metric scale and are ferrimagnetic materials. VSM measurements revealed that these nanoferrites are soft ferrimagnetic materials. The crystallite size R, porosity P, strain ε, Debye temperature, nanoparticle specific surface area, B-site force constant, elastic parameters and sheer and longitudinal velocities were increased with increasing the Cr^{3+} ion content *x*, whereas the lattice constant, density, grain specific surface area and A-site force constant were decreased. The strain ε proved dependence on P and R. Six absorption bands were observed in IR spectra and assigned to their corresponding sites and bonds. Thermal analysis of the samples displayed three steps of combustion process where the net loss of weight ranged 19%-33%. The saturation magnetization M_S of the samples was decreased against *x,* whereas the coercivity H_C was increased. Two peaks at 710 and 723 eV appeared in XPS spectra and attributed to Fe $2p_{3/2}$ and Fe $2p_{1/2}$. They reveal that the ratio of Fe^{2+} to Fe^{3+} ions increases with Cr ion increment.

Keywords: As-synthesized $Fe^{2+}Cr_xFe_{(2-x)}O_4$ nanoferrites; Magnetic properties; Resonant frequency; Debye temperature; XPS spectra.

*Corresponding author e-mail: moazamer@hotmail.com & mohamedamer@science.tanta.edu.eg