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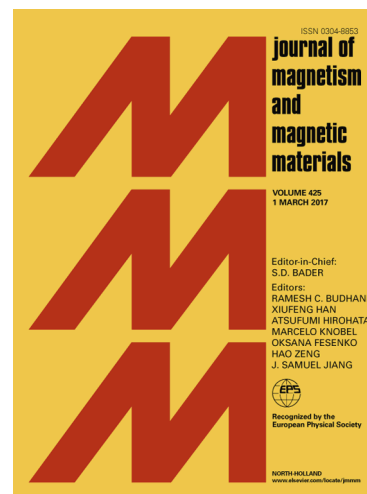
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## Effect of cobalt doping on crystallinity, stability, magnetic and optical properties of magnetic iron oxide nano-particles

Safia Anjum<sup>1</sup>, Rabia Tufail<sup>1</sup>, Khalid Rashid<sup>2</sup>, Rehana Zia<sup>1</sup>, S. Riaz<sup>3</sup>

<sup>1</sup>Department of physics, Lahore College for Women University, Lahore, Pakistan

<sup>2</sup>PCSIR Laboratories Lahore, Pakistan

<sup>3</sup>Centre for Solid State Physics, University of the Punjab, Lahore, Pakistan

### Abstract

This paper is dedicated to investigate the effect of  $\text{Co}^{2+}$  ions in magnetite  $\text{Fe}_3\text{O}_4$  nano-particles with stoichiometric formula  $\text{Co}_x\text{Fe}_{3-x}\text{O}_4$  where ( $x = 0, 0.05, 0.1$  and  $0.15$ ) prepared by co-precipitation method. The structural, thermal, morphological, magnetic and optical properties of magnetite and  $\text{Co}^{2+}$  doped magnetite nanoparticles have been carried out using X-ray Diffractometer, Fourier Transform Infrared Spectroscopy, Thermogravimetric Analysis, Scanning Electron Microscopy, Vibrating Sample Magnetometer (VSM) and UV-Vis Spectrometer (UV-Vis) respectively. Structural analysis verified the formation of single phase inverse spinel cubic structure with decrease in lattice parameters due to increase in cobalt content. FTIR analysis confirms the single phase of  $\text{Co}_x\text{Fe}_{3-x}\text{O}_4$  nanoparticles with the major band at  $887\text{ cm}^{-1}$ , which might be due to the stretching vibrations of metal-oxide bond. The DSC results corroborate the finding of an increase in the maghemite to hematite phase transition temperature with increase in  $\text{Co}^{2+}$  content. The decrease in enthalpy with increase in  $\text{Co}^{2+}$  concentration attributed to the fact that the degree of conversion from maghemite to hematite decrease which shows that the stability increases with increasing  $\text{Co}^{2+}$  content in B-site of  $\text{Fe}_3\text{O}_4$  structure. SEM analysis demonstrated the formation of spherical shaped nanoparticles with least agglomeration. The magnetic measurements enlighten that the coercivity and anisotropy of  $\text{Co}_x\text{Fe}_{3-x}\text{O}_4$  nanoparticles are significantly increased. From UV-Vis analysis it is revealed that band gap energy increases with decreasing particle size. This result has a great interest for magnetic fluid hyperthermia application (MPH).

**Keywords:** co-precipitation, nanoparticles, enthalpy, anisotropy, band gap energy

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