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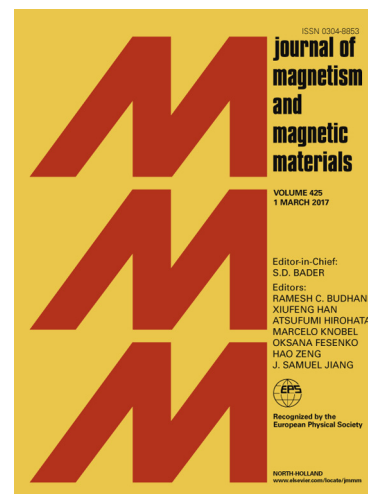
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# Investigation on Structural, Electrical and Magnetic Properties of Titanium substituted Cobalt Ferrite nanocrystallites

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## Abstract

The doping of parent compound with selective dopants usually enhances the properties of the parent compound. In this paper, Titanium doped cobalt ferrite nanoparticles ( $\text{Co}_{1-x}\text{Ti}_x\text{Fe}_2\text{O}_4$  with  $x=0-0.075$ ) via the sol-gel route is reported. The effect of titanium ions on the properties of cobalt ferrite is detailed. Structural evolution is confirmed using XRD technique and the titanium ion induced changes are given in terms of lattice constant, grain size, X-ray density, tetrahedral and octahedral hopping length and tetrahedral and octahedral bond length. The X-ray diffraction pattern displayed the formation of cubic inverse spinel structure belonging to the  $Fd3m$  space group. FTIR analysis confirmed the presence of characteristic peaks of ferrites around  $400\text{ cm}^{-1}$  and  $600\text{ cm}^{-1}$ . Raman spectroscopy revealed reduction in peak intensities of Raman active modes. SEM characterization had shown the formation of well resolved spherical particles. Elemental composition was evaluated by EDAX spectrum. TEM images also confirmed the spherical morphology of the nanocrystallites and crystallite size calculated is in agreement with that calculated from the XRD analysis. The SAED pattern shows uniform fringes of width  $0.428\text{ nm}$  belonging (222) plane. The diffraction pattern of HRTEM confirmed cubic spinel structure of the samples. Magnetic properties are evaluated from room temperature hysteresis loops. Increase in the saturation magnetization and coercivity was observed with increasing titanium content. Gradual increase in impedance with the increase in titanium concentration was estimated by impedance spectroscopy.

**Keywords:** Ti substituted Co ferrite, X-ray diffraction, HRTEM, VSM, Impedance analysis

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