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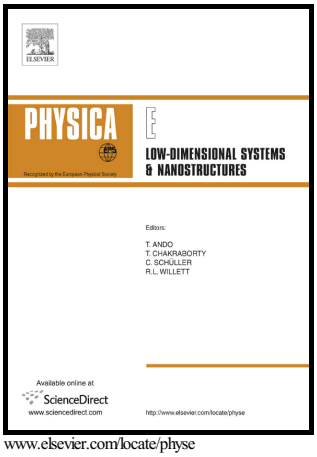

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Synthesis modified structural and dielectric properties of semiconducting zinc ferrospinels

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Abstract

The influence of preparation techniques on structural and dielectric properties of $ZnCr_xFe_{1-x}O_4$ (x=0, 0.1 abbreviated as Z and ZC) ferrite nano-particles synthesized using chemical co-precipitation (CCP), sol-gel (SG) and solid state reaction (SS) techniques is discussed. XRD profiles are used to confirm the single phase spinel ferrite formation. TEM images indicate the change in size and shape of particles on changing either the composition or the synthesis methodology. The TEM micrograph of samples obtained through CCP shows uniform particle size formation compared to those obtained through SG and SS. Sample prepared through CCP possess porosity >70% making these materials suitable for sensing applications. The dielectric loss, dielectric constant and ac conductivity are analyzed as a function of frequency, temperature and composition using impedance spectroscopy. A universal dielectric response and standard dielectric behavior has been reveled by temperature and frequency variations of each dielectric parameter. Dielectric constant is found to possess highest value for sample synthesized through SG which marks the possibility of using the SG derived ferrospinels as microwave device components.

Keywords: Magnetic materials; chemical synthesis; impedance spectroscopy; dielectric properties

1. Introduction

Nanocrystalline ferrite materials have achieved a primary position of economic and engineering importance within the family of magnetic materials because of their excellent physical and dielectric properties as compared to their bulk counterpart. Physical and dielectric properties of ferrite materials are highly influenced by size, shape of grains, grain boundaries, porosity, composition and preparation techniques [1–3]. The possibility of preparing ferrite nano-particles