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Structural, dielectric and electrical properties of nanocrystalline Mg1-xZnxPryFe2-yO4

The present work reports the structural, dielectric and electrical properties of nanocrystalline Mg1-xZnxPryFe2-yO4 ($0.0 \leq x \leq 1.0$; $y = 0.0, 0.1$) ferrites synthesized by novel solution combustion method. All the synthesized samples were characterized by X-ray diffraction (XRD), Fourier transform infrared spectroscopy (FTIR), scanning electric microscopy (SEM) and Energy dispersive x-ray analysis (EDAX). Dielectric parameters and complex impedance measurements were carried out as a function of frequency and composition at 300K. XRD patterns of synthesized samples revealed the formation of single-phase cubic spinel structure. It was observed the lattice parameter increased with increase in Pr+3 content. Moreover, the average crystallite sizes were found in the range 23-28 nm. X-ray density was found in the range 4.567- 5.201x103 kg/m3. Morphological observation showed the presence of agglomeration, spherical and polygon irregular shaped particles. Chemical compositions of the sample were identified based on EDAX spectra. The values of dielectric parameters and imaginary parts of impedance have been decreased while ac conductivity increased with increase in frequency. The dielectric dispersion in the samples has been understood by Koop's theory and Maxwell–Wagner type of interfacial polarization. Moreover, the dielectric parameters and ac conductivity have been increased and attain a maximum value beyond which they decreased with increase Zn2+ ion concentration. Finally, the lattice parameter increases while dielectric parameters were significantly reduced with Pr3+ ion substitution.

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