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AC Impedance Spectroscopy, Conductivity and Optical Studies of Sr doped Bismuth Ferrite Nanocomposites

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Effect of Sr doping on the structural, optical, dielectric, impedance properties of citrate combustion reaction route prepared $Bi_{1-x}Sr_xFeO_3$ (BSFO) nanocomposite has been investigated. The study of Fourier Transform Infrared Spectroscopy confirms the formation of perovskite structure of the Sr doped bismuth ferrite samples. SEM analysis shows decrease in grain size with increasing Sr concentration in BSFO nanocomposite. UV–visible absorption spectra in the spectral range 1.0–3.5 eV showed two doubly degenerate d–d transitions and two charge transfer transitions and optical band gap is found to decrease from 2.14 to 2.05 eV with increasing Sr concentration. Studies of frequency and temperature dependences of dielectric permittivity, impedance and electric modulus of the materials in broad frequency (20 Hz- 1 MHz) and temperature (30^o C – 500^oC) ranges using a complex impedance spectroscopy technique have provided interesting information on the contribution of the microstructure in these parameters. It has been observed that dielectric constant and dielectric losses decreases as the doping of Sr increased from x=0.1 to x=0.3 and attained a maximum value for BSFO (x = 0.1) sample. Impedance analysis indicates the presence of grain (bulk) and grain boundary resistive contributions which are found to increase with the increased Sr content. The ac conductivity of the samples is found to be frequency and temperature dependent and also vary with extent of Sr doping in BFO. Charge transport through short as well as long range conduction contributions has been indicated in different temperature regions of conductivity studies.

Keywords: Bismuth ferrite; microstructure; dielectric response; complex impedance spectroscopy

FULL TEXT