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Electronic Structure, Magnetic Behavior and Impedance Spectroscopy of Fe Doped $Ba_{0.7}Sr_{0.3}Tio_3$ Ceramics

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Barium strontium titanate ($Ba_{1-x}Sr_xTiO_3$, abbreviated as BST) being ecofriendly material, is the most promising candidate for ferroelectric devices due to its excellent properties of high dielectric constant, low leakage current and adjustable Curie temperature (T_C). The doping of magnetic ion 'Fe' at 'Ti' site not only reduces dielectric loss but also induces magnetism in it. However, very less is known about the magnetic properties and electronic structures of the Fe-doped BST solid solutions. Present investigation focuses on the structural, magnetic, electrical and electronic properties of Fe doped BST ceramics. Bulk samples with composition $Ba_{0.7}Sr_{0.3}Fe_xTi_{1-x}O_3$ where x =0, 0.1, 0.2, 0.3 were synthesized via conventional solid state reaction route. The Rietveld refinement confirmed the coexistence of the tetragonal and cubic phases for samples with Fe content x= 0, 0.1 and pure cubic phase for x > 0.1. The M–H hysteresis curves for samples with composition x = 0.1 and 0.2 exhibit paramagnetic behaviour even at low temperatures and composition with x = 0.3 shows the nature of weak ferro- and ferri-magnetic orderings at about 2K. This strange magnetic behavior in the samples can be due to the presence of mixed valence states as observed from Fe L_3-edge XANES spectra. The Ti $L_{3,2}$-edges at the XANES spectra confirmed that the doping of Fe in ABO_3 structure leads to the lattice distortion. The XANES spectra of the Ba L_3-edge and Sr L_3-edge spectra does not show any influence from dopants in the BST system. The electrical behavior was studied by complex impedance spectroscopy as a function of frequency (1 Hz to 1 MHz) at different temperatures (RT to 700K). The values of activation energies calculated from electrical impedance, modulus and conductivity data clearly reveal that the relaxation and conduction processes in prepared ceramics are induced by doubly ionized oxygen vacancies.

Biography:

Anumeet Kaur pursuing her Ph.D in material science with thesis entitled (**Multiferroic Properties of Magnetic Ion doped Ferroelectric Ceramics**) at Department of Physics, Guru Nanak Dev University, Amritsar, Punjab, India. She is working in the field of Multiferroics and her thesis proposal is mainly focused on the synthesis of an environment friendly magnetoelectric material with large ME coupling coefficient.