Dopant effects on the structural, optical and electromagnetic properties in multiferroic $Bi_{1-x}Y_xFeO_3$ ceramics

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Abstract: Multiferroic $Bi_{1-x}Y_xFeO_3$ (x = 0.00, 0.05, 0.1, 0.15, 0.2) ceramics were prepared by conventional solid-state-reaction method. X-ray diffraction measurement was carried out to characterize the crystal structure and to detect the impurities existing in these ceramics. The substitution of rare earth Y for Bi was found to decrease the impurity phase in $BiFeO_3$ ceramics. There is strong evidence that both lattice constants a and c of the unit cell unusually change at Y content of about x = 0.10. The effect of introducing Y^{3+} is shown to increase the optical band gap for doped sample $Bi_{1-x}Y_xFeO_3$. Additionally, the Raman measurement performed for the lattice dynamics study of $Bi_{1-x}Y_xFeO_3$ samples reveals a strong band centered at around 1150-1350 cm^{-1} which is associated with the resonant enhancement of two-phonon Raman scattering in the multiferroic $Bi_{1-x}Y_xFeO_3$ samples. The impedance spectroscopy indicates that, the Y dopant has improved the grain impedance. The enhancement of magnetization was observed in Y-doped samples compared to pure $BiFeO_3$.

Author Keywords: Magnetization; Multiferroics; Raman spectroscopy

Index Keywords: Dopant effects; Doped sample; Electromagnetic properties; Impedance spectroscopy; Impurity phase; Lattice dynamics; Multiferroics; Raman measurements; Resonant enhancements; Unit cells; X-ray diffraction measurements; Y dopants; Y-doped; Ceramic materials; Crystal impurities; Crystal structure; Doping (additives); Lattice constants; Magnetization; Raman scattering; Raman spectroscopy; Solids; X ray diffraction; Iron oxides

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