ABSTRACT

This work deals with the investigation of different effects on the structural, magnetic and electric properties of Cd and Mn doped $Cd_{0.25}Bi_{0.75}Fe_{1-x}Mn_xO_3$ multiferroic material by taking fix ratio of Cd and varying Mn as x=0.0,0.5,0.10,0.15. Multifferoic samples of Cd-Mn doped samples were synthesized by simple chemical micro-emulsion method. Samples were calcinated at 700°C for 2h to obtain BFO single phase material. The synthesized samples were characterized by many different techniques such as X-ray difrectrometer (XRD), Scanning electron microscope (SEM), Fourier transform infrared spectroscopy (FTIR), LCR meter . Structural distortion observed at A-site and B-site of BFO due to doping of Cd at A-site and Mn at B-site. The structural and surface morphological studies of the samples before and after doping were conducted using the X-ray diffraction (XRD) and scanning electron microscope (SEM) respectively. XRD results revealed a provskite structure having crystalline size 24-54 nm. As substitution of Cd-Mn in BFO increases, grain size of doped samples going to decrease as investigate by XRD and SEM data which is up to 30 nm. Absorbtion bands in FTIR at 438 cm^{-1} and 558 cm^{-1} confirm the formation of provskite structure in Cd-Mn doped BFO samples. For the confirmation of elements and to investigation of oxidation states of elements X-ray Absorption Spectroscopy (XAS) is widely used technique. $L_{3,2}$ edges are observed in Iron (Fe) and Manganese (Mn) containing samples. These $L_{3,2}$ edges are the confirmation of Iron (Fe) and Manganese (Mn) in our samples and there is no shift in the peaks of $L_{3,2}$ edges, which confirmed no oxidation state change in Iron (Fe) and Manganese (Mn). $M_{4,5}$, $N_{4,5}$ edges are observed for Cadmium (Cd) and Oxygen (O) containing samples which confirm the presence of Cadmium (Cd) and Oxygen (O) in our samples and no shift in peaks of $M_{4,5}$, $N_{4,5}$ edges showed that there is no oxidation state change .Multiferroic materials like BFO have low dielectric values of dielectric constant as determined by (Inductance capacitance resistance) LCR meter. Dielectric constant of CD-Mn doped BFO can be determined by (Inductance capacitance resistance) LCR meter in the range of 1MHz to 3 GHz. Dielectric constant decreases as applied frequency increases and at higher frequency resonance peaks observed. After substitution of Cd^{3+} (0.97 A°) and Mn^{3+} (0.46 A°) with Bi^{3+} (1.03 A°) and Fe^{2+} (0.645 A°) respectively dielectric constant decreases, In sample $BiFe_{1-x}Mn_xO_3$ where x= 0.05 dielectric constant value is minimum Dielectric constant decrease due to orientational polarization which cannot keep up with alternating applied field frequency and at this frequency dielectric constant becomes constant.