

# ABSTRACT

This work deals with the investigation of different effects on the structural, surface morphology and magnetic properties of Sn doped  $\text{BiFe}_{1-x}\text{Sn}_x\text{O}_3$  Multiferroic material by varying Sn as ( $x=0.0, 0.02, 0.04, 0.06, 0.08, 0.10$ ). Sn doped Multiferroic samples were synthesized by simple chemical micro-emulsion method. Sample was calcinated at  $700^\circ\text{C}$  for 2h to obtain BFO single phase material. The synthesized samples were characterized by different techniques such as X-Ray diffractometer (XRD). Scanning electron microscope (SEM). Fourier transforms infrared spectroscopy (FTIR). Energy dispersive X-ray spectroscopy (EDS). Vibrating Sample Magnetometer (VSM). Structural distortion observed at A-site and B-site of BFO due to doping of Sn. 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 the rhombohedral perovskite structure having crystallite size 42-63 nm. As substitution of Sn in BFO increases grain size of doped samples going on decrease as investigated by XRD and SEM data which is up to 42 nm. According to the XRD results, it is evident that Sn ions have been effectively incorporated into the crystal structure of  $\text{BiFeO}_3$ . The surface morphology of undoped and Sn-doped  $\text{BiFeO}_3$  samples have been characterized by using FESEM. The results of SEM micrographs of Sn-doped  $\text{BiFeO}_3$ , synthesized by micro-emulsion method clearly show that submicron spherical particles are formed. It is suggesting that samples are changing their morphology by doping Sn at Fe sites and these samples are well crystalized particles. In pure sample well distributed particles are seen. The surface morphologies of samples at higher doping concentration of "Sn" in  $\text{BiFeO}_3$ , the particle size is going on decreasing. Absorption bands in FTIR at  $545\text{ cm}^{-1}$  and  $555\text{ cm}^{-1}$  confirm the formation of perovskite structure in Sn doped BFO samples. Absorption bands appear at  $555\text{ cm}^{-1}$  is associated to O-Fe-O stretching and bending vibrations. This is characteristics of  $\text{FeO}_6$  octahedral in perovskite structure. Energy dispersive X-ray spectroscopy (EDS) checked from the obtained products clearly demonstrates the presence of Sn in the prepared products. Vibrating Sample Magnetometer (VSM) tells us about the magnetic behavior of materials. The hysteresis loops are not wide which indicates that these materials are soft multiferroic.