ABSTRACT

The enigmatic theory of multiferroics has triggered the search, discovery and development of new materials with the knowledge of the intriguing physics for recent technology and application. The bismuth based layered structures (BLS) belonging to Aurivillius family show interesting physical properties varying as a function of external parameters (temperature, frequency, electric and magnetic field). These materials are of interest due to their lower dielectric constant, stronger anisotropic electrochemical coupling, higher stability, higher transition temperature and higher operating frequency. Some Fe/Mn containing BLS compounds can show ferroelectric and ferromagnetic properties simultaneously, and hence exhibit magnetoelectric (ME) effect under the influence of an external magnetic/electric field. Moreover, most spectacular changes in physical properties of BLS have been observed (i) when lanthanide cations are substituted at the Bi^{3+} sites and, (ii) by changing the number of perovskite layers in BLS. Among the lanthanides, the lanthanum (La) modified BLS compounds are found very promising candidates for advanced applications. Therefore, on expecting the La substitution at Bi site to enhance the multiferroic property, a detailed structural, electrical and magnetic property of eight layered La substituted BLS has been carried out in this thesis work. BLS compounds of $Bi_{9-x}Fe_{5+x}Ti_3O_{27}$ (x = 0-3) (group-I) and $Bi_{9-x}La_xFe_5Ti_3O_{27}$ (x = 1-9) (group-II) have been investigated to envisage the optimization of multiferroic properties. Preliminary crystal structure analysis by XRD revealed that the group-I and II compounds have an orthorhombic crystal structure with platelet like grains distributed throughout the surface representing the anisotropic behavior of the BLS compounds. Dielectric anomaly as a function of temperature and frequency arises due to ferro-paraelectric transition/space charge relaxation/change in magnetic order in different compounds. Combined approach of impedance and modulus spectroscopy gave a deep insight to the contribution from grain, grain boundary, and electrode effect on the electrical properties of BLS compounds. All the BLS compounds of the present work show antiferromagnetic behavior at room temperature.

Keywords: Bismuth layered structures, Ferroelectrics, Phase transition, Multiferroics.