**Abstract**

The 0.94(Na0.5Bi0.5TiO3)–0.06BaTiO3 ceramics have been prepared by the conventional solid state reaction method. Structural analysis of the prepared ceramic was made by means of room temperature XRD, FT-IR and Raman spectra. The formation of perovskite structure is confirmed by XRD and Raman studies. The dependence of dielectric constant on temperature for various frequencies (100 Hz–1.2 MHz) has been determined. The diffuse transition is observed in the variation of dielectric constant and it provides evidence for the relaxor characteristics. The relaxation mechanism of the prepared ceramic is also discussed in detail by using Debye, V–F and Power law relations and the suitable model was predicted by means of goodness of parameter. This is the first time the relaxation process is discussed for the lead free system to the best of our knowledge. High piezoelectric properties with d33=206 pC/N are observed in the present system.