Synthesis, Dielectric and Ferroelectric Behaviour of Lead-free KBT-BT Ceramics

K.Aravinth[1,*], P. Ramasamy[1]
SSN Research Centre, SSN College of Engineering, Kalavakkam 603 110, India
*Dr. Karuppanan Aravinth: aravinthk@ssn.edu.in

Most electromechanical devices are made of piezoelectric materials, particularly high frequency and miniaturized ones like transducers, sensors and actuators. They are widely used in medical diagnoses and therapy, communication non-destructive evaluation and underwater acoustics. Lead oxide-based pervoskite exhibit some of the highest piezoelectric coefficient of PMN-PT, PZN-PT etc. and are now widely used in these applications. The toxicity of lead made these materials expelled from commercial applications and materials concerning the environment safety regulations. K0.5Bi0.5TiO3 was first described by Smolenskii et.al in 1959, to be a pervoskite-type ferroelectric structure and belong to tetragonal crystal system at room temperature. Substitution of potassium and bismuth ions for barium ions in (1-x) BaTiO3 - xK0.5Bi0.5TiO3 leads to an increase in Curie temperature from 120 oC (x = 0) to 380 oC (x = 1). Lead free pervoskite 0.65 K0.5Bi0.5TiO3- 0.35 BaTiO3 (KBBT) ceramics were fabricated via conventional solid state processing technique sintered at 1100 oC and their crystal structures and electrical properties were systematically studied. Structure of the prepared KBBT ceramics was confirmed by Powder X-ray diffraction analysis. The sintered KBBT ceramics belongs to tetragonal system at room temperature. The dependence of dielectric constant on temperature for various frequencies (100 Hz-1 MHz) has been measured. The diffuse transition is observed in the variation of dielectric constant and it provides evidence for the relaxor characteristics. The ferroelectric response of the KBBT ceramics with different frequency was studied. Polarisation electric field hysteresis loops revealed that the remnant polarization is 18.2 μC/cm2 and coercive electric field is 35.4 kV/cm.