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SYNTHESIS, STRUCTURAL AND ELECTRICAL PROPERTIES OF NANOCRYSTALLINE BARIUM TITANATE CERAMIC USING MACHANOCHEMICAL METHOD

Barium Titanate (BaTiO3 or BT) ceramics were synthesized by using a combination of solid state and mechanochemical method. The thermal decomposition, phase formation, microstructure and electrical behavior are investigated by TG-DSC analysis, X-ray diffraction, FE-SEM measurements and Impedance Analyzer respectively. The X-ray diffraction patterns show cubic symmetry without secondary phase. The lattice parameter a, c/a ratio and crystal size was found to be 4.0070 A˚, 1.0000 and 31.2 nm respectively. The Porosity of the samples has been obtained through X-ray density and bulk density. The FESEM results indicated dense microstructure with an average grain size of 144.53 nm. Frequency dependence of dielectric permittivity and loss, have been studied in the range of 30-150oC and 40 Hz–1 MHz, respectively. Frequency dependent dielectric study of the sample shows a normal ferroelectric phase transition behavior. The dielectric constant and loss of BT at room temperature are 1600 and 0.77 respectively. The temperature dependence of dielectric permittivity shows that phase transition seems to be shifted towards lower room temperature with phase transition temperature observed at 90oC. The hysteresis loop was observed having a remanent polarization (Pr) and coercive field (Ec) of 0.27 Pr (μC/cm2) and 581.73 Ec (V/cm) respectively. The Cole-Cole plots of complex dielectric constant showed a non-Debye type of dielectric relaxation. Relaxation time was found to decrease with increasing temperature and to obey the Arrhenius relationship. The value of activation energy 〖(E〗_a) for the bulk, as calculated from the slope of versus 〖τ〗_g Temperature curve, is observed to be 1.47 eV.

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