International Journal of ChemTech Research
CODEN (USA): IJCRGG, ISSN: 0974-4290, ISSN(Online):2455-9555
Vol.12 No.02, pp 223-233, 2019

Phase development and dielectric responses in PMN–KBT solid solutions

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Abstract : (1-x)PbMg$1_{/3}$$Nb_{2/3}$$O_3$(PMN)-(x)$K_{0.5}Bi_{0.5}TiO_3$ (KBT)) materials(with x = 0.15,0.25 and 0.35) were prepared by double sintering conventional mixed-oxide method. X-ray powder diffraction patterns reveal that the crystal structure of PMN-KBT crystal changes from cubic to tetragonal symmetry with increasing amounts of KBT(x). The dielectric and ferroelectric properties of PMN-KBT crystals with different compositions near the morphotropic phase boundary (MPB) were studied systematically. The dielectric constant and dielectric loss tangent were measured as a function of both temperature and frequency from impedance data. With increasing KBT content, the frequency dependence of the transition temperature and the diffuseness of phase transition is observed in dielectric peak for sintered specimens. High-phase transition temperature (T_m) of 319◦C was obtained at 1 kHz for the composition x = 0.35. The diffuse phase transition(DPT) of the samples were assessed and the broadest dielectric peak occurs at x = 0.35, with diffusivity value γ = 1.86, which leads to a morphotropic phase boundary in this system. In order to study ferroelectric property of (1-x) PMN–(x)KBT ceramics, polarization vs. electric field (P–E) hysteresis loops were traced at room temperature under different applied field. It is observed that the loop area is increased as the applied voltage has increased. The remnant polarization (P_r)and coercive field (E_C) are also increased as the applied voltage is increased.

Keywords : Ferroelectrics, lead magnesium niobate (PMN), Potassium bismuth titanate (KBT), PMN–KBT, sintering.

Kebede Legesse *et al* /International Journal of ChemTech Research, 2019,12(2): 223-233.

DOI= http://dx.doi.org/10.20902/IJCTR.2019.120230

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