MS16-P04 | PEROVSKITE $BaTiO_3$ DOPED WITH PYROCHLORE BISMUTH ZINC NIOBATE - A NEW PEROVSKITE RELAXOR FERROELECTRIC BZN-BT

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The novel perovskite lead-free ferroelectric relaxor system $Bi_{1-y}(Zn_{1/3}\ Nb_{2/3})_xO_3$-$Ba_yTi_{(1-x)}O_3$ (BZN-xBT), has been investigated in a range of compositions from x= 0 to x=0.2 using x-ray powder diffraction, SEM, dielectric and piezoelectric measurements. Studies of bulk-ceramic samples revealed a maximum in the piezoelectric coefficient d_{33} of 120 pC N^{-1}at x = 0.038 together with a coercive field of E_c = 9.3 kV cm^{-1}. Powder x-ray diffraction studies in the temperature range from 295K to 20K show this system having considerable polar phase coexistence with the highest d_{33} correlating with dominance of the monoclinic phase at room temperature. The tetragonal perovskite structure characteristics of BT at room temperature disappears between x=0.06-0.07.

Low-temperature x-ray powder diffraction studies in the range 295-20K indicate a BT-like sequence of phase transitions from tetragonal-orthorhombic-rhombohedral for x=0 to x=0.04. Beyond x=0.04, the rhombohedral phase no longer appears. Appearance of a potential Morphotropic Phase Boundary (MPB) is signalled by the collapse of the tetragonal c_T/a_T ratio near x = 0.045, which ratio then shows relative invariance with temperature over the whole interval. Above x=0.07, after the tetragonal phase has been eliminated at room temperature, BZN-BT appears as essentially an almost invariant mixture of monoclinic (Cm) and orthorhombic (Amm2) phases at all temperatures measured,

Piezoelectric coefficients showed a rapid decline for x > 0.039 at 295K. For 0.045 < x < 0.08, the materials are lossy dielectrics (T_m ~295K) and potentially candidate electrocalorics.