Stress and Electric-Field Driven Structural Transformation in $(1-x)Bi(M'_{1/2}M''_{1/2})O_3$-$xPbTiO_3$ Piezoceramics

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$PbTiO_3$-based morphotropic phase boundary (MPB) ceramics such as $Pb(Zr_xTi_{1-x})O_3$ (PZT), $(1-x)Pb(Mg_{1/3}Nb_{2/3})O_3$-$xPbTiO_3$ (PMN-PT), $(1-x)Pb(Zn_{1/3}Nb_{2/3})O_3$-$xPbTiO_3$ (PZN-PT) having excellent piezoelectric property are widely used for sensors, actuators, transducers and data storage devices[1-4]. Electric field induced structural transformations is a common feature of the compositions close to MPB, due to the heightened sensitive of the system to small stimulus like electric field, pressure or compositional variations[5-6]. We have investigated the nature of stress and electric field induced structural phase transformations in $(1-x)Bi(M'_{1/2}M''_{1/2})O_3$-$xPbTiO_3$ (M'=Fe, Ni etc and M''= Ti, Zr, Nb, Sn, Hf etc) MPB piezoceramics. To study the ex-situ electric-field driven phase transformation, pellets of different compositions of $(1-x)Bi(M'_{1/2}M''_{1/2})O_3$-$xPbTiO_3$ ceramics were poled at room temperature on silicon oil bath and crushed into fine powder. Composition which appears to be pseudo-cubic in the unpoled state shows co-exiting cubic and tetragonal phases after poling. On the other hand, the compositions which showed a coexistence of cubic and tetragonal phases in the unpoled state transformed to tetragonal on application of electric field. Similar changes were obtained when on application of pressure in these piezoceramics.

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