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Electric field induced phase transition and accompanying giant poling strain in lead-free $NaNbO_3$-$BaZrO_3$ ceramics

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Abstract:

A series of phase transitions in (1-x)$NaNbO_3$-x$BaZrO_3$ ((1-x)NN-xBZ) ceramics was observed from antiferroelectric orthorhombic phase to ferroelectric orthorhombic phase and finally into ferroelectric rhombohedral phase with increasing x. An electric field induced irreversible phase transition was found in different compositions, irrespective of their virgin phase structures. Particularly, an antiferroelectric orthorhombic phase is irreversibly transformed into a ferroelectric monoclinic phase within $0.02 \leq x \leq 0.05$, leading to a giant poling strain of ~0.58%. This is much larger than that observed in ferroelectric orthorhombic ($0.06 \leq x \leq 0.07$) and rhombohedral phases ($0.08 \leq x \leq 0.11$) suffering from an irreversible ferroelectric-ferroelectric (monoclinic) phase transition. The synchrotron x-ray diffraction and the measurement of longitudinal and transverse strains suggest that this irreversible phase