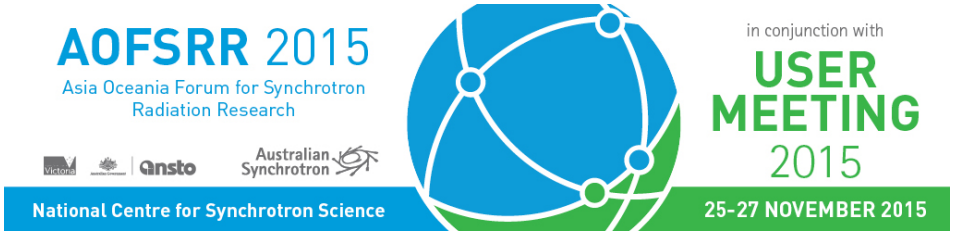

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Electric field and stress induced phase transformations in polycrystalline BaTiO3

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This work presents in situ high-energy synchrotron x-ray diffraction measurements on the polycrystalline BaTiO3 at temperatures above the Curie point (TC) during application of unipolar electric fields and uniaxial compressive stresses. The experimental observations provide insights into the general paraelectric/paraelastic to ferroelectric/ferroelastic phase transition behaviors and have important implications for the future development of high-strain lead-free electromechanical materials. The results show the transitions from the high temperature cubic paraelectric/paraelastic phase to a ferroelectric/ferroelastic tetragonal phase induced by the electric field and compressive stress. In both electrical and mechanical cases, the nature of the observed transitions was influenced by the proximity of the temperature to TC. With increasing temperature above TC, the transition electric field and stress both increased while the rate of transitions tended to decrease. At temperatures just above TC, a nearly saturated domain texture existed within the induced phase at the maximum stress (400 MPa) whereas the resultant tetragonal domain texture at the maximum electric field (4 kV mm−1) was not saturated.

Keywords

Ferroelectric, Ferroelastic, Phase transformation, X-ray diffraction, Barium titanate

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