Polarization-Oriented $Ba_{0.5}Sr_{0.5}TiO_3$ Thin Films

Beamline: X23A2

Category of Researcher: PRT member

Technique: NEXAFS

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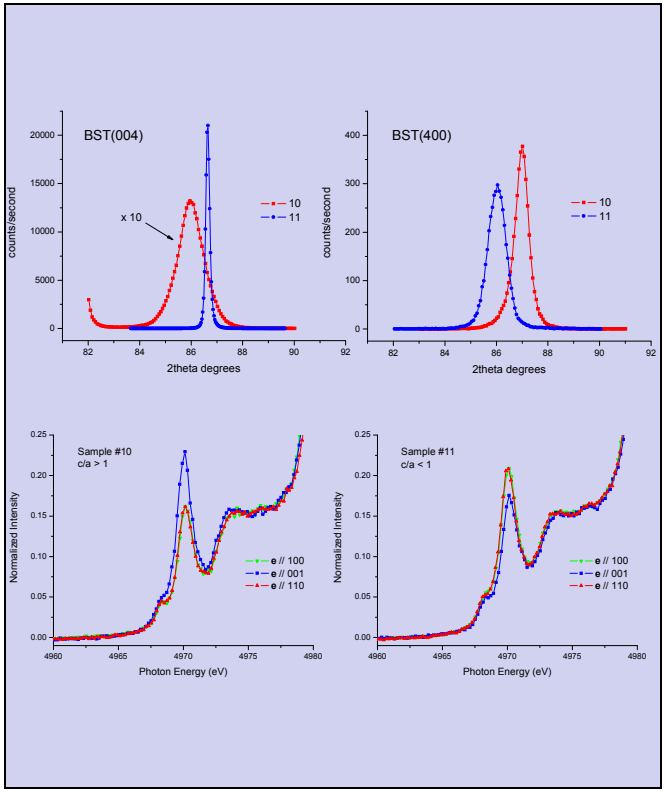
Publication: Spectroscopic determination of phase in tetragonally strained $Ba_{0.5}Sr_{0.5}TiO_3$ films at room temperature, *Appl. Phys. Lett.* 91, 052909 (2007).

Motivation: To explain the observed anisotropy of dielectric measurements on either compressive or tensile strained $Ba_{0.5}Sr_{0.5}TiO_3$ thin films grown on Mg(001) substrates.

Results: Sputter deposited $Ba_{0.5}Sr_{0.5}TiO_3$ thin films on Mg(001) substrates with either in-plane (c<a) or out-of-plane (c>a) tetragonal lattice structure distortions were characterized by polarization-dependent Ti K edge x-ray absorption fine structure (XAFS) spectroscopy. Anisotropy between the in-plane and out-of-plane directions in the films as determined by XAFS provided evidence of spontaneous polarization, and the anisotropy varied with the type of structural distortion thereby explaining the microwave measurements.



Top: (Left) $Ba_{0.5}Sr_{0.5}TiO_3$(004) diffraction and (Right) $Ba_{0.5}Sr_{0.5}TiO_3$(400) diffraction for two films grown on Mg(001) with either in-plane compressive or in-plane tensile strains.
Bottom: (Left) Ti K near edge spectra from the film with in-plane compressive strain (c>a). (Right) Ti K near edge spectra from the film with in-plane tensile strain (c<a). Note the different sense of the spontaneous polarization as determined by the near edge spectra.