Nanoscale Switching Characteristics of NearlyTetragonal $BiFeO_3$ Thin Films

Dipanjan Mazumdar[1], Vilas Shelke[1], Milko Iliev[2], Amit Kumar[3], Stephen Jesse[3], Sergei V. Kalinin[3], Arthur P. Baddorf[3], and Arunava Gupta[1]

ABSTRACT

We have investigated the nanoscale switching properties of strain-engineered BiFeO3 thin films deposited on LaAlO3 substrates using a combination of scanning probe techniques. Polarized Raman spectral analysis indicates that the nearly tetragonal films have monoclinic (*Cc*) rather than *P*4*mm* tetragonal symmetry. Through local switching-spectroscopy measurements and piezoresponse force microscopy, we provide clear evidence of ferroelectric switching of the tetragonal phase, but the polarization direction, and therefore its switching, deviates strongly from the expected (001) tetragonal axis. We also demonstrate a large and reversible, electrically driven structural phase transition from the tetragonal to the rhombohedral polymorph in this material, which is promising for a plethora of applications.