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Manipulation of the domain structure in mixed-phase BiFeO3 epitaxial films YI-CHUN CHEN, HSIN-HUA LEE, FENG-NAN CHU, WEN-CHUAN HSIEH, Department of Physics, National Cheng Kung University, Q. HE, Advanced Light Source, Lawrence Berkeley National Laboratory, WEN-I LIANG, YING-HAO CHU, Department of Materials Science and Engineering, National Chiao Tung University — Strain-induced phase transformation in epitaxial films is the newly advance in thin-film growth techniques. Under the compressive strain from the substrate, the stable phase of multiferroic BiFeO3 (BFO) films transformed from rhombohedrally- to tetragonally- distorted monoclinic perovskite, which simulated the material system near the morphotropic phase boundary. In this study, we used piezoresponse force microscopy (PFM) to investigate the intrinsic domain structures in the mixed-phase BFO epitaxial films. PFM taken along the principal crystallographic directions revealed the domain polarizations. The IP PFM images indicated the coexistence of at least two monoclinic phases with IP distortions along [100] and [110]. The domains were distributed in the way to minimize the local electrostatic energy, and the mixed phase pattern can be effectively controlled by external fields. The dynamic switching parameters for the domain and phase manipulation, such as switching speed, switching direction, and applying voltages, were systematically investigated. This study provides basic understanding and electrical control of this unique phase boundary.

Yi-Chun Chen
Department of Physics, National Cheng Kung University

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