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Component-Layer-Dependent Distortion of Striped Domains in PbTiO3/SrTiO3 Superlattices[1] PICE CHEN, MARGARET COSGRIFF, QINGTENG ZHANG, University of Wisconsin-Madison, SARA CALLORI, Stony Brook University, BERNHARD ADAMS, ERIC DUFRESNE, Argonne National Laboratory, MATTHEW DAWBER, Stony Brook University, PAUL EVANS, University of Wisconsin-Madison — Weakly-coupled ferroelectric/dielectric superlattices show novel ferroelectric properties that are not accessible in compositionally uniform ferroelectrics. Nanoscale polarization striped domains are formed as a result of the minimization of the energy associated with depolarization fields. The dielectric layers are polarized, however, with a magnitude that is much smaller than in the ferroelectric layers. The unequal distribution of polarization has been predicted to induce layer-dependent dynamics of the polarization switching of striped domains. Here we experimentally test this prediction in a PbTiO3/SrTiO3 superlattice with time-resolved x-ray diffraction under electric fields up to 2.38 MV/cm. The intensities of x-ray reflections arising from striped domains decrease at a nanosecond timescale, as the polarization switching occurs. The relative magnitude of the intensity change depends on the indices of reflections. We compared the observed intensity changes of domain reflections with a kinematic x-ray simulation. The measurement agrees with a model in which the average polarization of striped domains in dielectric SrTiO3 layers is slightly increased under applied electric fields, and the ferroelectric PbTiO3 layers are unchanged.

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