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Magnetoelectric Coupling in Complex Oxide Heterostructures
JASON HOFFMAN, CARLOS VAZ, Department of Applied Physics, Yale University, HAJO MOLEGRAAF, University of Twente, JEAN-MARC TRISCONE, University of Geneva, CHARLES AHN, Department of Applied Physics, Yale University — Current efforts to use materials with multifunctional capabilities have renewed interest in multiferroics, which display a coupling between ferroic order parameters. Engineered structures that combine dissimilar magnetic and ferroelectric systems epitaxially have been shown to exhibit enhanced magnetoelectric coupling. In this work, off-axis RF magnetron sputtering was used to deposit epitaxial ferroelectric $Pb(Zr,Ti)O_3$ (PZT) / $La_{0.8}Sr_{0.2}MnO_3$ (LSMO) heterostructures with high crystalline quality and atomically smooth surfaces. X-ray diffraction shows c-axis oriented growth of PZT, with a typical root-mean-square (RMS) surface roughness of 5Å. We employ magneto-optic Kerr effect (MOKE) magnetometry to study directly the local magnetic state of the LSMO as a function of the PZT polarization state. We demonstrate direct control of magnetism via applied electric fields, including on/off switching of magnetism. The coupling between magnetic and electric order parameters in ferroelectric / Sr-doped lanthanum manganite heterostructures is illustrated by hysteretic M-E (magnetization vs. electric field) loops, with a measured magnetoelectric susceptibility of $\alpha \sim 1$Oe cm / kV^{-1}.

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