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Magnetic microscopy and simulation of strain-mediated control of magnetization in Ni/PMN-PT nanostructures IAN GILBERT, Center for Nanoscale Science and Technology, NIST, ANDRES CHAVEZ, Department of Mechanical and Aerospace Engineering, UCLA, DANIEL PIERCE, JOHN UNGURIS, Center for Nanoscale Science and Technology, NIST, WEI-YANG SUN, CHENG-YEN LIANG, GREGORY CARMAN, Department of Mechanical and Aerospace Engineering, UCLA — We describe high resolution magnetic microscopy of electric-field manipulation of magnetization in multiferroic heterostructures comprised of Ni films and nanostructures deposited on ferroelectric $[Pb(Mg_{1/3}Nb_{2/3})O_3]_{0.68}[PbTiO_3]_{0.32}$ (PMN-PT). An applied electric field strains the PMN-PT via the converse piezoelectric effect, changing the magnetic easy axis of the adjacent ferromagnetic layer through magnetostriction. Using scanning electron microscopy with polarization analysis, we image the vector magnetization of the Ni film and submicron disks before and during the application of an electric field. We observe the film's magnetization rotates by 90 degrees upon the application of an electric field. The magnetic vortices present in the Ni disks are compressed into two antiparallel domains oriented along the easy axis defined by the strain. We then use these data to quantitatively demonstrate that a fully coupled micromagnetic-elastodynamic simulation represents the magnetization response to strain more accurately than a simple spatially-uniform uniaxial strain in a standard micromagnetic simulation using only the Landau-Lifshitz-Gilbert equation.

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