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Reversible Magnetoelectric Control of Exchange Coupling in Monodomain BiFeO3 Heterostructures[1] JULIAN IRWIN, W. SAENRANG, M.S. RZCHOWSKI, K.J. REIERSON, Dept. of Physics, Univ. of Wisconsin, J.E. PODKAMINER, S.B. BAEK, C.B. EOM, Dept. of Materials Sci. and Engr., Univ. of Wisconsin, J.W. FREELAND, APS, Argonne National Laboratory, B.A. DAVIDSON, CNR-Istituto Officina dei Materiali, TASC Nat. Lab, Trieste, Italy
— We investigate reversible switching of the ferromagnetic properties of a monodomain thin film of the multiferroic $BiFeO_3$ (BFO) [2] and a Co overlayer. For different electric polarization directions of the BFO film we observe changes in the Co layer magnetic anisotropy and coercive field as determined from in-plane and out-of-plane anisotropic magnetoresistance (AMR) and Magneto-Optic Kerr Effect (MOKE) measurements between 30K and 300K. The dependence of these results on BFO layer thickness is also investigated due to the thickness dependence of BFO's cycloidal magnetic ordering. X-ray linear dichromism (XLD) measurements of the BFO layer indicate a reversible change in the BFO magnetic ordering as a result of polarization switching, verifying the presence of a magnetoelectric effect in the BFO film and suggesting a magnetic coupling between the BFO and Co layers. Weak ferromagnetism and changing surface magnetic anisotropy energy are both explored as possible mechanisms for the observed coupling.[2]

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[2]S.H. Baek et al., "Ferroelastic Switching for Nanoscale Nonvolatile Magnetoelectric Devices" Nature Materials, 9, 309, (2010)

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