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Micromagnetic simulations and experimental calibration of magnetic behavior in multiferroic $BiFeO_3$ DIANA QIU, KHALID ASHRAF, SAYEEF SALAHUDDIN, University of California, Berkeley — $BiFeO_3$ (BFO) is a magnetoelectric multiferroic that exhibits ferroelectric and antiferromagnetic (AFM) ordering at room temperature. BFO films are frequently coupled to a ferromagnet (FM) layer grown on the BFO surface, but the behavior of the magnetization in BFO films and at the BFO/FM interface is not understood. We propose a micromagnetic model for the magnetization in BFO in which spin canting throughout the film, induced by the Dzyaloshiskii-Moriya (DM) effect, creates weak ferromagnetism on the BFO surface. This surface ferromagnetism is significantly enhanced by an exchange interaction with the FM at the BFO/FM interface. We perform OOMMF micromagnetic simulations of BFO/CoFe bilayers and reproduce experimentally reported one-to-one mapping between BFO and CoFe domains as well as enhanced magnetic moment on the BFO surface, on the order of 0.5 μ_B per unit cell. From this model, we can extract AFM/FM exchange energies and DM energies by fitting experimentally reported values for BFO surface magnetic moment and hysteresis. We also demonstrate that magnetization switching of the BFO domains can induce switching in the FM. We reproduce experimentally observed 180 $^\circ$ total magnetization switching through 90 $^\circ$ switching in stripe-like domains.

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