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Bipolar exchange bias modulation in $La_{0.7}Sr_{0.3}MnO_3$/ $BiFeO_3$ heterostructure based field effect devices STEPHEN WU, SHANE CYBART, JAMES PARKER, PU YU, R. RAMESH, R.C. DYNES, University of California,Berkeley / Lawrence Berkeley National Lab — We have fabricated and performed electrical transport measurements on a multiferroic field effect device with a $BiFeO_3$ (antiferromagnetic/ferroelectric) gate dielectric and a $La_{0.7}Sr_{0.3}MnO_3$ (ferromagnetic) channel to investigate the effect of $BiFeO_3$ (BFO) polarization on interfacial magnetism by using exchange bias as a diagnostic tool. A reversible static shift in exchange bias through zero applied magnetic field is observed by electrically poling BFO. This bipolar exchange bias modulation behavior strongly suggests that interfacial magnetization is being reversed through the application of electric field. To investigate this phenomenon further we have measured temperature dependent exchange bias, temperature dependent resistivity, and Hall Effect coefficients on multiple devices. Also a comparison to an identical control device using a $Pb(Zr_{0.2}Ti_{0.8})O_3$ (ferroelectric) gate dielectric and $La_{0.7}Sr_{0.3}MnO_3$ (LSMO) channel is offered, which provides insight into the interfacial magnetic interactions uniquely occurring in the BFO/LSMO system. We analyze these results in the context of proposed models, which suggest that we are modulating both carrier density and interfacial magnetic coupling strengths; both of which have a strong effect on the bipolar modulation of exchange bias.

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