Abstract Submitted
for the MAR12 Meeting of
The American Physical Society

Effects of inhomogeneous strain on the magnetization behavior of magnetic nanostructures in $BiFeO_3/CoFe_2O_4$ composite NICOLAS AIMON, MARK MASCARO, FRANK LIU, MIT DMSE, MARKUS BUEHLER, MIT Mechanical Engineering Department, CAROLINE ROSS, MIT DMSE — In $CoFe_2O_4/BiFeO_3$ (CFO/BFO) nanostructured thin films, where ferromagnetic nanopillars are embedded in a ferroelectric matrix, electric field induced rotation of the easy axis of the ferrimagnetic nanopillars has been demonstrated experimentally [Zavaliche et al. 2005]. However, for applications where the magnetic pillars would be used to store information, electric control of the magnetization has to be acheived at the scale of a single pillar, without disturbing the neighbors, and the effects of local strain on the magnetic reversal is therefore of interest. We carried out finite element simulations of the strain state of an arrangement of CFO pillars when the BFO matrix surrounding one of them is under piezoelectric strain. Because of stress relaxation at the top free surface of the thin film, the strain is highly inhomogeneous along the pillar. The position-dependent strain was imported into a micromagnetic simulation, giving a position-dependant magnetoelasticity, to predict the switching behavior of the CFO pillars and estimate the feasibility of electric control of a single magnetic bit in this system. The reversal of the pillars was found to be highly incoherent, showing that the pillars cannot be treated as a macrospin.

Nicolas Aimon
mit

Date submitted: 10 Nov 2011 Electronic form version 1.4