Abstract Submitted
for the MAR06 Meeting of
The American Physical Society

Fabrication and Electrical Measurements of $CoFe_2O_4$ Nanopillars in a $BiFeO_3$ matrix[1] SCOTT RUTHERFORD[2], University of Wisconsin - Madison, RASMI DAS[3], University of Wisconsin - Madison, XIANGLIN KE[4], University of Wisconsin - Madison, DMITRY RUZMETOV, Northwestern University, DONGMIN KIM[5], University of Wisconsin - Madison, SEUNG HYUB BAEK[6], University of Wisconsin - Madison, MARK RZCHOWSKI[7], University of Wisconsin - Madison, CHANG-BEOM EOM[8], University of Wisconsin - Madison, CHANG-BEOM EOM COLLABORATION, MARK RZCHOWSKI COLLABORATION, NORTHWESTERN UNIVERSITY COLLABORATION — Coupling between ferromagnetic and ferroelectric ordering has recently stimulated many scientific and technological interests. This "coupling", would provide an additional degree of freedom in the design of micro and nano-electronic devices such as actuators, transducers, or memories. Unfortunately, the clamping effect of the substrate negates any such magnetoelectric coupling through elastic interactions which evident in a multilayer structures. Therefore our focus is directed towads the design of a novel vertically aligned oxide nano-structures, which will allow us to switch the magnetic domains by applying the electric field and vice versa. These nano-structures will also be used as model system to understand the physics of order parameter coupling in ferrroelctric and ferromagnetic systems. We have fabricated ferromagnetic nanopillar arrays of $CoFe_2O_4$ (CFO), surrounded by a ferroelectric $BiFeO_3$ (BFO) and $BaTiO_3$ matrix. 90^0 off-axis sputtering is used to deposit $SrRuO_3$ (SRO), followed by CFO on single surface TiO_2-terminated $SrTiO_3$ (001) substrates. SRO provides a good lattice match and electrode capabilities for the subsequent deposition of CFO. E-beam patterning defines pillar dimensions and spacing, while ion milling etches down to the SRO layer. The pillar dimensions range between 100 nm and 500 nm in diameter and are spaced 0.5 to 1 μm apart. Atomic force microscopy and scanning electron microscopy measurements confirm the structure of the pillars following the patterning and etching steps. The BFO ferroelectric matrix is then deposited by on-axis sputtering. Fabrication of these pillars along with piezo force micrcroscopy and magnetic force microscopy was used to understand the microstructure and domain switching. The detailed scanning probe measurements of domain switching in these novel oxide nanostructures will be discussed.

[1]Fabrication and Electrical Measurements of CoFe2O4 Nanopillars in a BiFeO3 matrix
[2]Materials Science Department
[3]Materials Science Department
[4]Physics Department
[5]Materials Science Department
[6]Materials Science Department
[7]Physics Department
[8]Materials Science Department

Scott Rutherford
University of Wisconsin - Madison

Date submitted: 30 Nov 2005 Electronic form version 1.4