Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Origin of Electrical Conduction in Domain Walls of $BiFeO_3$ Thin Films[1] JAMES LEE, ANOOP DAMODARAN, LANE MARTIN, PETER ABBAMONTE, University of Illinois at Urbana-Champaign, HELEN HE, RAMAMOORTHY RAMESH, University of California at Berkeley — $BiFeO_3$ thin films grown on $DyScO_3$ substrates unexpectedly exhibit metallic electrical conduction at ferroelectric (FE) domain walls (DWs). Resonant x-ray scattering near Fe L and O K absorption edges was used to probe the electronic structure of these films. In-plane wavevectors of resonant Fe edge magnetic scattering, and non-resonant Cu K α diffraction peaks near the (0, 0, 1) $BiFeO_3$ Bragg peak, match the domain period observed by PFM. Fe edge scattering intensifies as the beam energy is tuned to Fe 2p $\rightarrow$ ligand-3d transitions. No O K charge scattering is observed. These results suggest that metallic conduction does not arise from charge build- up at the DWs from FE polarization discontinuities, but from the bandgap closing near DWs as the crystal symmetry changes from rhombohedral-like in the domain bulk to higher-symmetries.

[1]Funding: US DOE grant DE-FG02-06ER46285.

James Lee
University of Illinois at Urbana-Champaign

Date submitted: 19 Nov 2010 Electronic form version 1.4