Abstract Submitted
for the MAR07 Meeting of
The American Physical Society

Ferroelectricity and Polarization-Dependent Tunneling in $BaTiO_3$ Films Below 10 Layers ARTHUR P. BADDORF, JUNSOO SHIN, SERGEI V. KALININ, Oak Ridge National Laboratory, VON BRAUN NASCIMENTO, E. WARD PLUMMER, University of Tennessee — Predictions for the minimum critical film thickness for ferroelectricity have continuously decreased. For $BaTiO_3$, ferroelectricity has previously been observed experimentally down to 12 layers and predicted by first-principles calculations in 6 layer films. We have examined $BaTiO_3$ ultra-thin films grown on $SrRuO_3/SrTiO_3$ using laser-MBE in high oxygen pressures and report evidence of a ferroelectric state at room temperature by in-situ characterization of structure, using low energy electron diffraction (LEED I-V) and by scanning tunneling spectroscopy (STS). Films produce sharp (1x1) LEED patterns, indicating well-ordered tetragonal phase structure. Comparison of observed diffraction intensities for 4 and 10 layer films at 130 and 300 K with calculated intensities reveals a vertical displacement of the central Ti, corresponding to a polarization consistent with compressive strain. Reversible polarization switching was observed locally as a jump in the electron tunneling current at +/- 2.5 V using a scanning tunneling microscope. Research was sponsored by the Division of Materials Sciences and Engineering and the Center for Nanophase Materials Sciences, Office of Basic Energy Sciences, U.S. Department of Energy with Oak Ridge National Laboratory, managed and operated by UT-Battelle, LLC.

Arthur Baddorf
Oak Ridge National Laboratory

Date submitted: 20 Nov 2006 Electronic form version 1.4