Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Polar structure evolution of ultrathin $BaTiO_3$ films: in-situ LEED I-V[1] JUNSOO SHIN, Department of Physics and Astronomy, Louisiana State University, Baton Rouge, LA 70803, USA, VON BRAUN NASCIMENTO, DIOGO DUARTE DOS REIS, Departamento de Física, ICEx, Universidade Federal de Minas Gerais, Belo Horizonte, MG, Brazil, LINA CHEN, E. WARD PLUMMER, JIANDI ZHANG, Department of Physics and Astronomy, Louisiana State University, Baton Rouge, LA 70803, USA — Understanding the fundamental physics of ferroelectricity in ultrathin films is a key issue of a critical size, of which a strong debate has erupted over the existence for decades. Ferroelectricity has previously been observed experimentally down to a few unit cells, depending on a complex interplay of electrostatic depolarization energy, domain formation, and so on. Using in situ Low Energy Electron Diffraction (LEED) I-V, we have systematically examined the structure evolution of ultrathin fully strained $BaTiO_3$ films (1-12 ML) on Nb-doped $SrTiO_3$. Comparison of observed diffraction intensities for 10 ML films at 300 K with calculated intensities reveals a vertical displacement of the central Ti, corresponding to a single-domain upward polar state. To investigate the polar structure evolution of ultrathin films, we have calculated all R-factors between two sets of experimental curves from 1 ML to 12 ML with 10 ML polar structure curve as a reference. As a result, we demonstrate that 8-12 ML thick $BaTiO_3$ films have very similar polar structures, whereas thinner films (1-7 ML) have continuously evolved from uncorrelated to correlated polar structures.

[1]This research at LSU was supported by U.S. DOE under Grant No. DOE DE-SC0002136.

Junsoo Shin
Dept of Physics and Astronomy, Louisiana State University,
Baton Rouge, LA 70803, USA

Date submitted: 11 Dec 2012 Electronic form version 1.4