Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Epitaxial strain induced phase transitions in La-doped $BiFeO_3$ thin films on Si substrates DEYANG CHEN, CHRISTOPHER T. NELSON, XIAOHONG ZHU, CLAUDY R. SERRAO, YA GAO, DI YI, JIAN LIU, RAMAMOORTHY RAMESH, Univ of California - Berkeley, DECHANG ZENG, South China University of Technology, DARREL G. SCHLOM, Cornell University, CONCEPT TEAM, SOUTH CHINA UNIVERSITY OF TECHNOLOGY COLLABORATION, CORNELL UNIVERSITY COLLABORATION — Epitaxial strain is a powerful pathway to trigger phase transitions with emergent phenomena in oxide thin films, e.g., strain induced ferroelectric to ferroelectric (PE-PE) phase transition from tetragonal-like to rhombohedral-like phase in $Pb(Zr_xTi_{1-x})O_3$ and $BiFeO_3$ films. In this study, we report a strain driven antiferroelectric to ferroelectric (AFE-FE) phase transition from orthorhombic (O) to rhombohedral (R) phase in $La_xBi_{1-x}FeO_3$ (LBFO) thin film on Si substrates. The ground state of $La_xBi_{1-x}FeO_3$ bulk is antiferroelectric $PbZrO_3$ type orthorhombic phase. We show that epitaxial strain from Si substrates can stabilize a rhombohedral structure of LBFO in 20 nm films and intermediate strains position LBFO into a nanoscale mixture of rhombohedral and orthorhombic phases in 30-100 nm films and then strain relaxation in 125nm films leads to the orthorhombic phase. Transmission electron microscopy (TEM) shows atomically sharp O/R morphotropic phase boundary (MPB) with O phase domains larger than 10 nm in width. In summary, our findings open a new path to drive AFE-FE phase transition in LBFO and provide a route to study O/R MPB.

Deyang Chen
Univ of California - Berkeley

Date submitted: 16 Nov 2013 Electronic form version 1.4