Abstract Submitted
for the MAR13 Meeting of
The American Physical Society

Local conductivity in supertetragonal and rhombohedral-like $BiFeO_3$ films SAEEDEH FAROKHIPOOR, University of Groningen, CHRISTIANNE BEEKMAN, WOLTER SIEMONS, HANS M. CHRISTEN, Oak Ridge National Laboratory, BEATRIZ NOHEDA, University of Groningen — Materials in which structural polymorphs coexist are of great interest in the design of magnetoelectric devices and piezoactuators at the nanoscale. In $BiFeO_3$, coexisting polymorphs are stabilized in thin film form by strain resulting from film/substrate lattice mismatch and/or thermal expansion differences. In films on $LaAlO_3$ substrates, these polymorphic phases give rise to stripe patterns; they are formed by the coexistence of the highly-strained (T') phase with an intermediary polymorph (S') in samples devoid of the rhombohedral-like relaxed (R') structure. Here, we investigate the local properties of the stripe patterns by piezoresponse force microscopy and conductive atomic force microscopy. This makes it possible to investigate the local conductivity both of specific domains and of different domain walls, and to compare the results to those obtained for R'-$BiFeO_3$ films (on $SrTiO_3$ substrates). We show that patterns of locally varying polarization and conductivity can be reversibly written and erased at length scales determined by the phase stability of the strain-induced structural polymorphs, and illustrate similarities and differences between R' and T' $BiFeO_3$.

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Date submitted: 09 Nov 2012 Electronic form version 1.4