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Chemical Control of Ferroelectric Switching in $PbTiO_3$ Films[1]
RUEY-VEN WANG, STEPHEN STREIFFER, Center for Nanoscale Materials, Argonne National Laboratory, FAN JIANG, PAUL FUOSS, DILLON FONG, JEFFREY EASTMAN, G. BRIAN STEPHENSON, Materials Science Division, Argonne National Laboratory, KUJTIM LATIFI, CAROL THOMPSON, Department of Physics, Northern Illinois University — Stabilization of monodomain polarization in ultrathin ferroelectric films can be accomplished via surface-adsorbed ions [Fong, D. D. *et al.*, *Phys. Rev. Lett.* **96**, 127601/1-4 (2006)]. Here, we use in-situ grazing-incidence synchrotron x-ray scattering to study the ferroelectric polarization and surface structure of $PbTiO_3$ ferroelectric thin films as a function of vapor environment above the film surface. Coherent $PbTiO_3$ films of 10 nm thickness were grown on conducting $SrRuO_3$ on (001) $SrTiO_3$ substrates. We observe that the polarization direction in the $PbTiO_3$ film can be reversed by changing between oxidizing and reducing atmospheres, and the piezoelectric butterfly loop can be traced out as a function of oxygen partial pressure. Additionally, a new surface reconstruction is observed under reducing conditions.

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