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X-ray Studies of Chemical Switching of $PbTiO_3$ on $SrRuO_3$ CAROL THOMPSON, Dept. of Physics, Northern Illinois Univ., R.-V. WANG, D.D. FONG, F. JIANG, S.K. STREIFFER, P.H. FUOSS, J.A. EASTMAN, G.B. STEPHENSON, Argonne National Laboratory — Recent studies have shown that monodomain polarization can be stabilized in thin films not only through the presence of electrodes that provide electronic compensation at the film interfaces but also through surface-adsorbed ions or charged interfacial defects/impurities. Here, we use real-time synchrotron x-ray scattering to investigate changes in the polarization of $PbTiO_3$ films induced by varying the chemistry of the vapor above the film surface. We observe that the sign of the polarization can be reversibly switched by changing the partial pressure of oxygen (pO_2) in equilibrium with the film surface. The dependence of film lattice parameter on pO_2 is bistable, following a butterfly loop analogous to that observed under applied voltage. The large compressive strains observed in the thinnest films prior to switching indicate that the chemical switching process can result in electric fields approaching the intrinsic coercive field for $PbTiO_3$. Work supported by the U. S. Department of Energy under Contract No. DE-AC02-06CH11357.

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