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Polarization Switching at the Intrinsic Coercive Field of $PbTiO_3$ by Changing Oxygen Partial Pressure M. HIGHLAND, T.T. FISTER, M.-I. RICHARD, D.D. FONG, J.A. EASTMAN, S.K. STREIFFER, P.H. FOUSS, G.B. STEPHENSON, Argonne National Laboratory, Argonne, IL, CAROL THOMPSON, Dept. of Physics, Northern Illinois University, DeKalb, IL — Previously we have found that changing the partial pressure of oxygen in the gas above ultrathin $PbTiO_3$ films on $SrRuO_3$ can induce inversion in the sign of the polarization. Here we present x-ray measurements that allow us to determine the polarization magnitude and domain distribution during switching. For films of thickness above ∼5 nm, switching occurs by the usual mechanism of nucleation and growth of 180 ° domains having the same polarization magnitude but opposing signs. However, in thinner films switching of the polarization occurs without nucleation; the polarization magnitude decreases to zero and changes sign uniformly without domain formation, indicating that the intrinsic coercive field (E_{IC}) is reached. Since E_{IC} has never been reached in oxide ferroelectrics using applied electric field, our results suggest that the barrier to nucleation is large during chemical switching. Work supported by the Dept. of Energy under Contract DE-AC02-06CH11357.

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