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Effects of Substrate Polarity, Strain, and Chemical Boundary Conditions on Ferroelectricity in $PbTiO_3$ on $DyScO_3$ M. HIGHLAND, D.D. FONG, J.A. EASTMAN, S.K. STREIFFER, T. FISTER, P.H. FUOSS, G.B. STEPHENSON, Argonne National Laboratory, Argonne, Illinois 60439, USA, CAROL THOMPSON, Department of Physics, Northern Illinois University, DeKalb, Illinois 60115 — Novel substrate materials such as $DyScO_3$ have recently been used to control the epitaxial strain imposed on ferroelectric films such as $PbTiO_3$, since epitaxial strain effects are predicted to strongly modify the phase transition temperature and domain structure. In addition, the polar nature of these substrates can be expected to impose a different electrical boundary condition than would arise at a traditional non-polar substrate surface such as $SrTiO_3$ (001). Chemical conditions at the free surface can also affect polarization in ultrathin films. Here we report synchrotron x-ray investigations of the domain structure and polarization as a function of temperature and oxygen partial pressure for ultrathin films of $PbTiO_3$ on $DyScO_3$. We observe that the substrate surface charge imposes a strong bias on the net polarization of the film, which can be overcome at low temperatures by the chemical effect of the environment. Work supported by the U. S. Department of Energy under Contract No. DE-AC02-06CH11357.

M. Highland
Argonne National Laboratory, Argonne, Illinois 60439, USA

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