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Nanoscale Ferroelectric Switching in Thin Films by in-situ TEM for Magnetoelectric Applications CHRISTOPHER NELSON, PENG GAO, JACOB JOKISAARI, University of Michigan, COLIN HEIKES, CAROLINA ADAMO, ALEXANDER MELVILLE, Cornell University, SEUNG-HYUB BAEK, CHAD FOLKMAN, University of Wisconsin-Madison, BENJAMIN WINCHESTER, YIJIA GU, Penn State University, YUANMING LIU, University of Washington, KUI ZHANG, University of Michigan, ENGE WANG, School of Physics, Peking University, China, JIANGYU LI, University of Washington, LONG-QING CHEN, Penn State University, CHANG-BEOM EOM, University of Wisconsin-Madison, DARRELL SCHLOM, Cornell University; Kavli Institute at Cornell for Nanoscale Science, Ithaca, XIAOQING PAN, University of Michigan — The ferroelectric switching along the low-dimensional axis of nanoscale multiferroic $BiFeO_3$ thin films is studied in this work using in-situ transmission electron microscopy. With this technique, the atomic scale polarization distribution and the controlling influence of defects on growth kinetics are observed. Despite the inhomogeneous external field applied by a surface probe, nucleation sites are determined by the built-in fields formed within carrier depletion regions at the electrode interfaces. Homogenous full-film switching is often impeded by the pinning of domain growth by such features as point defect assemblies and from independent switching in the near-interface region. This inhomegeneity along the normal film axis has significant implications for the interpretation of surface probe ferroelectric switching measurements and for magnetoelectric applications which require ferroelastic switching at the interface.

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