Abstract Submitted
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Resolving Deterministic Mesoscopic Mechanisms of Local Bias-Induced Phase Transitions in Ferroelectric Materials[1] S.V. KALININ, S. JESSE, M.P. NIKIFOROV, P. MAKSYMOVYCH, N. BALKE, A. BADDORF, H.J. CHANG, A.Y. BORISEVICH, S.J. PANNYCOOK, S. CHOUDHURY, Y. LI, L.-Q. CHEN, OAK RIDGE NATIONAL LAB TEAM, PENN STATE UNIV. TEAM — Polarization switching in ferroelectric and multiferroic materials is invariably controlled by defects that act as nucleation and pinning site. Using the synergy of high-resolution spectroscopic Piezoresponse Force Microscopy, materials systems with atomically engineered defects, and phase field modeling, we demonstrate that deterministic mesoscopic mechanisms of polarization switching can be determined. In particular, the artificial bicrystal grain boundary in (100) $BiFeO_3$ is found to impede ferroelectric switching, but facilitate ferroelastic switching for one of the constituent crystals. The coupling between ferroelastic domain walls and ferroelectric polarization switching is demonstrated and attributed to the kinetic effects. These studies open the pathway for probing kinetics and thermodynamics of local bias-induced phase transitions and dissipation on a single-defect level using field confinement by an SPM tip. The future potential for atomistic studies is discussed.

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