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Correlated Switching Dynamics in the Nanoscale Proximity of 90° Ferroelectric Domain Walls SHIMING LEI, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA, United States., XUEYUN WANG, S.W. CHEONG, Department of Physics and Astronomy and Rutgers Center for Emergent Materials, Rutgers University, Piscataway, NJ, United States., L.Q. CHEN, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA, United States., SERGEI KALININ, The Center for Nanophase Materials Sciences, Oak Ridge National Laboratory, Oak Ridge,Tennessee., VENKATRAMAN GOPALAN, Department of Materials Science and Engineering, The Pennsylvania State University, University Park, PA, United States. — Ferroelectrics are materials which have a built in polarization in their crystal structure even in the absence of an electric field. Domain walls themselves can possess dramatically different properties than the bulk ferroelectrics themselves. Previously we discovered that the universally present 180° walls have an order of magnitude lower domain switching threshold field than the bulk. This effect extends up to many microns around a wall, though the wall itself is unit cell thick. Here we present new results on 90° walls in $PbTiO_3$ single crystals that show similar proximity effect and correlated switching. Our SSPFM imaging across the $a/c/a$ domain walls suggests a strong correlated switching behavior in the proximity of the inclined 90° domain walls, even at a small AC driving voltage of 1V without DC bias on the tip. Consistent with phase-field modeling results, the inclined extended domain walls is found to act as nucleation sites in ferroelectric materials, and give rise to the domain wall asymmetrical broadening across the domain wall.

Shiming Lei
Department of Materials Science and Engineering,
The Pennsylvania State University,
University Park, PA, United States

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