Local Probe Studies of Switching and Current Dynamics in $Pb(Zr_{0.2}Ti_{0.8})O_3$ Thin Films

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Defects and electrostatic boundary conditions have been shown to greatly impact the intrinsic configuration, geometry and growth dynamics of polarization domains in ferroelectric thin films. Indeed, defects can induce different switching dynamics, where the polarization reversal can be dominated by the nucleation of new domains or by the lateral growth of existing domains[1-3]. Defects such as oxygen vacancies can also play an important role in controlling the electrical conduction at ferroelectric domain walls[4] and, in conjunction with electrostatic boundary conditions can even allow fully reversible control of this phenomenon[5].

Here, we present our results on $Pb(Zr_{0.2}Ti_{0.8})O_3$ thin films showing both different switching dynamics and different domain wall current behaviours in samples grown by pulsed laser deposition and off-axis RF magnetron sputtering. Using piezoresponse force microscopy (PFM) and conductive atomic force microscopy (c-AFM) in ultra-high vacuum, we study the nanoscale nucleation and motion of domains as a function of applied tip voltage and their relation to the corresponding currents and defect densities.

References

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