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Imaging the Dynamics of the Ferroelectric Stripe Phase Near a Field-Driven Phase Transition in Bismuth Ferrite[1] NOUAMANE LAANAIT, QIAN LI, Oak Ridge National Lab, ZHAN ZHANG, Argonne national Lab, SERGEI KALININ, Oak Ridge National Lab — Electric field-driven phase transitions in multiferroic systems such as Bismuth Ferrite could potentially host interesting domain dynamics due to the coexistence of multiple order parameters. Structural imaging of these dynamics under a host of elastic and electric boundary conditions is therefore of interest. Here, we present X-ray diffraction microscopy (XDM) studies of the domain wall dynamics in a bismuth ferrite thin-film near the field-driven transition from rhombohedral to monoclinic (R to M). XDM is a novel full-field imaging technique that uses Bragg diffraction contrast to image structural configurations with sub-100nm lateral resolutions and fast acquisition times (milliseconds to seconds per image). We find that under electric fields ˜100 kV/cm, a bismuth ferrite thin-film (100 nm BiFeO3/DyScO3 (110)) undergoes a structural phase transition but that this new phase (M) is pinned by the preexisting ferroelectric/ferroelastic stripe phase (R). At higher fields (˜300 kV/cm), we observe unusually slow domain wall dynamics in the stripe phase, consisting of periodicity doubling, domain wall roughening and crowding. These observed ferroelastic domain wall spatial dynamics are weakly constrained by the crystal symmetry of the orthorhombic substrate but exhibit nonlinear dynamics more commonly associated with disordered nematic systems.

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