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Atomic-level sculpting in STEM for studies of thickness dependent structural behavior in oxide thin films ALBINA BORISEVICH, QIAN HE, STEPHEN JESSE, Oak Ridge National Lab, ANDREW AKBASHEV, JONATHAN SPANIER, Drexel University, MIGUEL FUENTES-CABRERA, BOBBY SUMPTER, Oak Ridge National Lab — Oxide thin films offer a rich playground for fundamental physics and possible applications due to a wide variety of electronic and magnetic properties and control of chemistry and strain conditions during growth. Scanning Transmission Electron Microscopy (STEM) studies of thin films often demonstrate that film structure is highly dependent on thickness; changes in overall symmetry at a two-atomic-layer scale have been reported. At the same time it was recently shown that crystalline oxide nanostructures can be grown locally during a STEM experiment from amorphous precursors. This method can be used for producing crystalline structures as small as 1-2 nm and the process can be observed *in situ* with atomic resolution. Here we utilize the sculpting approach to study size effects in ultrathin films of oxides as they are being grown inside a microscope. Transitions such as emergence of tilted structure, misfit defects and rotational domains can now be pinpointed with single atomic layer precision. Atomistic molecular dynamics simulations are used to establish theoretical underpinnings of the beam-induced growth mechanism. This work is funded by DMSE of the DOE BES (QH, AB), and by CNMS, which is funded at ORNL by SUFD of the DOE BES.

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