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**When is one layer complete? Using simultaneous in-situ RHEED and x-ray reflectivity to map layer-by-layer thin-film oxide growth**[1] M.C. SULLIVAN, Ithaca College, Dept. of Physics, Ithaca NY, M.J. WARD, H. JORESS, A. GUTIERREZ-LLORENTE, A.E. WHITE, A. WOLL, J.D. BROCK, Cornell High Energy Synchrotron Source, Cornell University, Ithaca NY — The most popular tool for characterizing *in situ* layer-by-layer growth is Reflection High-Energy Electron Diffraction (RHEED). X-ray reflectivity can also be used to study layer-by-layer growth, as long as the incident angle of the x-rays is far from a Bragg peak. During layer-by-layer homoepitaxial growth, both the RHEED intensity and the reflected x-ray intensity will oscillate, and each complete oscillation indicates the addition of one layer of material. However, it is well documented, but not well understood, that the maxima in the RHEED intensity oscillations do not necessarily occur at the completion of a layer. In contrast, the maxima in the x-ray intensity oscillations do occur at the completion of a layer, thus the RHEED and x-ray oscillations are rarely in phase. We present our results on simultaneous *in situ* x-ray reflectivity and RHEED during layer-by-layer growth of $SrTiO_3$ and discuss how to determine the completion of a layer for RHEED oscillations independent of the phase of the RHEED oscillation.

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