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Time Resolved X-ray Diffraction Study During Pulsed Laser Deposition

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We have studied the initial growth of films by pulsed laser using time resolved x-ray diffraction techniques. *In-situ* X-ray surface diffraction measurements with 5 ms resolution were performed during homoepitaxial growth of SrTiO₃ on (001) oriented substrates in ~80 mTorr of Oxygen. In addition to the surface truncation rod intensity oscillations at the anti-Bragg position (equivalent to RHEED oscillations), we also observed an abrupt change in diffracted intensity with the arrival of each pulse of ablated material. The prompt nature of the ablation process, provides a sharp starting time for observing the evolution of the surface structure after arrival of the ablated material. All of the measurements were performed on the UNICAT undulator beam line at the Advanced Photon Source, which yielded diffracted intensities of up to 8×10^4 counts/sec at the anti-Bragg positions. This high intensity makes it feasible to obtain data with milli-second range time resolution. The surface diffraction chamber used for this work will be described, and the analysis of the time resolved data in terms of a simple deposition and aggregation model will be discussed.

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