Abstract Submitted
for the MAR10 Meeting of
The American Physical Society

Surprises in the PLD of $LaAlO_3$: non-stoichiometric transfer of material from target to film T.C. DROUBAY, L. QIAO, M.H. ENGELHARD, T.C. KASPAR, V. SHUTTHANANDAN, S.A. CHAMBERS, PNNL — Despite being composed from two band insulators, the $LaAlO_3/SrTiO_3(001)$ interface has been of significant interest due to its electrical conductivity. The conductive interface has been explained as resulting from charge transfer from polar LAO to non-polar STO. Most investigations into this interface have used pulsed laser deposition (PLD) as the deposition method. Contrary to popular assumptions, however, ablation from a LAO target does not necessarily produce congruent (stoichiometric) transfer of material from target to substrate. To determine the atom distribution within the laser plume from an LAO target, films were collected on stationary 2" Si wafers held at room temperature to eliminate re-evaporation and minimize lateral diffusion. The film composition was then analyzed using both x-ray photoelectron spectroscopy (XPS) and Rutherford backscattering spectrometry (RBS). Regardless of the gas pressure in the chamber, we find that the La:Al atom ratio varies as a function of angle in the plane formed by the laser axis and target normal. The La/Al atom ratio peaks at $\sim$1.6 in the on-axis position and approaches unity at a plume angle of 26 off-normal. This ratio is only minimally impacted by the kinetic energy of the ablation species. Growths of epitaxial LAO on STO(001) at 700 $^\circ$C reveal a similar trend. These results have significant implications for the mechanism of conductivity of LAO/STO grown by PLD.

Tim Droubay
Pacific Northwest National Lab

Date submitted: 14 Dec 2009 Electronic form version 1.4