Abstract Submitted
for the MAR11 Meeting of
The American Physical Society

Internal electric field in $SrTiO_3/LaAlO_3$ heterostructures probed with hard x-ray photoemission spectroscopy ERIK SLOOTEN, University of Amsterdam, Z. ZHONG, H. MOLEGRAAF, University of Twente, S. DE JONG, F. MASSEE, E. VAN HEUMEN, University of Amsterdam, M. GORGOI, Helmholtz Zentrum Berlin, G. RIJNDERS, D. BLANK, M. HUIJBEN, P. KELLY, University of Twente, M. S. GOLDEN, University of Amsterdam — The origin of the conducting layer at the interface between insulating $SrTiO_3$ (STO) and $LaAlO_3$ (LAO) is still widely debated. The alternatingly charged layers within the LAO blocks give rise to an internal electric field, which at some point has to be screened. This built-in potential is predicted to close the LAO bandgap at a critical thickness of 4 layers of LAO. Using hard x-ray photoemission spectroscopy we study the core levels of these systems as a function of the LAO layer thickness. By measuring the La 4d and Al 2s core levels with respect to the Sr 3d core level we carefully determine the core level shifts for samples with 2 to 6 layers of LAO. Although the observed shifts are an order of magnitude smaller than predicted, we do find an interesting increase of the core level shifts for samples with more than 4 layers. We perform DFT slab calculations to show that oxygen vacancies can significantly reduce the potential build-up. Our results suggest that in real materials the electronic reconstruction is pre-empted by other effects of which oxygen vacancies are one possibility.

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Date submitted: 19 Nov 2010 Electronic form version 1.4