## Abstract Submitted for the MAR15 Meeting of The American Physical Society

Surface reconstruction in (LaFeO3)m/(SrFeO3)n superlattices ALBINA BORISEVICH, Oak Ridge National Laboratory, ROHAN MISHRA, Vanderbilt University, YOUNG-MIN KIM, Korea Basic Science Institute, YUYUANG ZHANG, Vanderbilt University, SEOHYOUNG CHANG, SEONG KEUN KIM, ANAND BHATTACHARYA, Argonne National Laboratory, SOKRATES PAN-TELIDES, Vanderbilt University — We use scanning transmission electron microscopy and electron energy loss spectroscopy (EELS) to study the surface of a series of  $(LaFeO_3)_m/(SrFeO_3)_n$  films grown on  $SrTiO_3$  substrates using molecular beam epitaxy. From EELS, we observe dramatic changes in the Fe  $L_{2,3}$  edges, including shifts in the peak positions and changes in their crystal-field splitting, on moving from the bulk to the surface. Moreover, we observe these changes to extend several layers into the films rather than being restricted to the topmost layer. For example in a  $(LaFeO_3)_8/(SrFeO_3)_1$  superlattice, we observe that while the Fe oxidation state remains unchanged, a reversal in the intensity of the crystal-field split  $t_{2g}$  and  $e_g$  peaks occurs over a length of 5 unit cells suggesting a shift from octahedral coordination in the bulk to tetrahedral coordination at the surface. Simultaneously acquired annular bright field and dark field images allow us to map the associated changes in their structure, such as cation displacements and changes in oxygen columns. We combine these results with density functional theory calculations to give a complete picture of surface reconstruction in the studied films including changes in the electronic, magnetic properties and its effect on the adsorption of  $CO_2$  and  $H_2O$  molecules that could point to routes to tune surface properties for water splitting and other applications.

> Albina Borisevich Oak Ridge national Laboratory

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