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ATOMIC SCALE ANALYSIS OF COMPLEX OXIDE INTERFACES IN THE ABERRATION CORRECTED STEM

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Submitted to the Fifteenth American Conference on Crystal Growth and Epitaxy, in Keystone, Colorado, July 20-24, 2003

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prepared by

CONDENSED MATTER SCIENCES DIVISION
OAK RIDGE NATIONAL LABORATORY
Managed by
UT-BATTELLE, LLC.
under
Contract No. DE-AC-05-00OR22725
with the
U.S. DEPARTMENT OF ENERGY
Oak Ridge, Tennessee

March 2003

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The combination of atomic resolution Z-contrast microscopy and electron energy loss spectroscopy (EELS) in the Scanning Transmission Electron Microscope (STEM) provides a new level of insight into the structure/property relations of solids. In the aberration corrected STEM, the electronic structure of solids can now be probed with a spatial resolution close to 1 Å, the approximate value of ionic radii [1,2]. This level of resolution therefore allows the properties of interfaces to be probed in unprecedented detail. This work will present several examples of atomic resolution studies of the relationship between structure and electronic properties of complex oxide interfaces. The first example concerns interfaces in superconducting/ferromagnetic $YBa_2Cu_3O_{7-x}/La_{0.67}Ca_{0.33}MnO_3$ (YBCO/LCMO) superlattices, where direct evidence of charge injection from the ferromagnetic layer into the superconducting layers will be shown. Epitaxial strain can also have a large effect on the physical properties of ultrathin layers, and a clear example is found when studying the influence of epitaxial strain on doping in $YBa_2Cu_3O_{7-x}/PrBa_2Cu_3O_7$ (YBCO/PBCO) superlattices. Similarly, distributions of isolated atoms can deeply modify the physical properties of materials. Therefore, another example superlattice system, $CaTiO_3/La_{1-x}Ca_xTiO_3$ with low La doping, has been investigated to determine the sensitivity to single La atoms. These can be identified through intensity traces, and attempts to obtain single atom EELS data will be described.

[1] B. Rafferty, S.J. Pennycook. Ultramicoscopy **78** 141 (1999)
[2] G. Duscher, R. Buczko, S.J. Pennycook, S.T. Pantelides. Ultramicroscopy **86** 355 (2001).
[3] This research was supported by Oak Ridge National Laboratory, managed by UT-Battelle, LLC, for the U.S. Department of Energy under contract DE-AC05-96OR22725.