MAR11-2010-004305

Abstract for an Invited Paper
for the MAR11 Meeting of
the American Physical Society

Cross-sectional scanning tunneling microscopy and spectroscopy of fractured oxide surfaces and heterostructure interfaces[1]

TEYU CHIEN, Argonne National Laboratory

Recently, interfaces between novel oxide materials have become a playground for manipulation of new functionalities. At interfaces, the broken symmetry and the spatially confined environment have been shown to modify the local interactions and generate wholly new electronic phases (e.g. magnetism, metallicity, superconductivity etc.) distinct from the composite bulk materials. However, to date our understanding of these interface driven phases is still limited. While there exists powerful spatially resolved tools for visualizing the chemical and magnetic structure of an interface, a direct observation of electronic behavior across the interface presents a major experimental challenge. After the success of creating flat fractured surfaces on Nb-doped $SrTiO_3$ (Nb:STO) accessible to scanning tunneling microscopy (STM) [1-3], we have further harnessed the high-sensitivity to electronic local density of states (LDOS) of the scanning tunneling spectroscopy (STS) in cross-sectional geometry to visualize complex oxide interface electronic properties. By extending XSTM/S to the interface between colossal magnetoresistant manganite $La_{2/3}Ca_{1/3}MnO_3$ (LCMO) and semiconducting Nb:STO, we were able to map the LDOS across the boundary to unambiguously visualize the interface by the location of the valence band and elucidate the fundamental issue of band alignment at a complex oxide heterointerface [4].

[1] TeYu Chien *et al.*, *Appl. Phys. Lett.* **95**, 163107 (2009).
[2] Nathan P. Guisinger *et al.*, *ACS nano* **3**, 4132 (2009).
[3] TeYu Chien *et al.*, *J. Vac. Sci. Technol. B* **28**, C5A11 (2010).
[4] TeYu Chien *et al.*, *Phys. Rev. B* **82**, 041101(R) (2010).

[1]Use of the Center for Nanoscale Materials was supported by the U. S. Department of Energy, Office of Science, Office of Basic Energy Sciences, under Contract No. DE-AC02-06CH11357.