Surfaces of Layered Transition Metal Oxides

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Transition metal oxides (TMOs) exhibit complex behavior because the structural, electronic, and magnetic properties are strongly coupled. A small change in one property (e.g., structure) can produce a large change in another property (e.g., the magnetic state). Many of these materials are layered or quasi two-dimensional (2D), and some of the most interesting physical phenomena such as phase transitions are associated with and controlled by symmetry-breaking perturbations. A surface (or an interface) breaks the inherent symmetry in a solid and can thus change the order parameters associated with various types of transitions. We have used variable temperature STM (T> 25 K) (microscopy) and STS (spectroscopy) to image spatial variations in the electronic and structural properties. LEED and ELS have been applied to determine surface structure and electronic and vibrational excitations, respectively. We find the surface of cleaved Sr_2RuO_4 exhibits a c(2x2) reconstruction and a defect stabilized (1x1) structure, yet the surface is metallic at all temperatures measured. Images and spectroscopy of $La_{0.5}Sr_{1.5}MnO_4$ clearly show electron inhomogenities on the ~50 Å ≈ scale. Finally recent STM measurements on $La_{1.2}Sr_{1.8}Mn_2O_7$ will be presented.

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