MAR07-2006-003038

Abstract for an Invited Paper
for the MAR07 Meeting of
the American Physical Society

Probing the Electronic Structure of Metal Oxides using Resonant Inelastic Soft X-Ray Scattering and Soft X-ray Emission Spectroscopy.[1]

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While photoemission spectroscopy is often the probe of choice in studying the electronic structure of solids, there are many sample and environmental constraints that must be satisfied before meaningful data can be obtained with this spectroscopy. Specifically, samples generally need to be electrically conducting single crystals, with atomically clean and ordered surfaces. Clearly, complimentary electronic structure probes applicable to non-crystalline samples, insulators, or samples with poorly controlled surfaces are highly desirable. I will discuss the application of two such techniques: synchrotron radiation-excited soft x-ray emission spectroscopy and resonant inelastic x-ray scattering. By virtue of being photon-in/ photon-out probes, these techniques can measure the electronic structure of solids in circumstances where photoemission spectroscopy is inapplicable. Soft x-ray emission spectroscopy provides a direct measure of the element- and site-specific local partial density of states, while resonant inelastic soft x-ray scattering measures element specific low energy excitations such as d-d$*$or charge transfer transitions. Recent examples of the application of these spectroscopies to a variety of metal oxide systems, including correlated and low dimensional systems, will be presented. *Research supported in part by the Department of Energy under DE-FG02-98ER45680 and the AFOSR under FA9550-06-1-0157. Experiments were performed at the NSLS and the ALS, which are supported by the Department of Energy.*

[1]With: T. Learmonth, P.A. Glans, Y. Zhang (Boston U.); J. Guo (ALS); S. Hulbert (NSLS); D.J. Payne, R.G. Egdell (Oxford); A. Walsh, G.W. Watson, C. McGuinness (Trinity); A. Matsuura (AFOSR); J.E. Downes (Macquarie); and L.C. Duda, J. Nordgren (Uppsala).