Lecture 13
Some applications of XPS
The spectrum demonstrates the origin of metalliclicity upon doping. Look at the emergence of intensity at Fermi and the gradual disappearance with further doping. See the shift of LUMO.
This change in population is further demonstrated here.
Two distinct states can be demonstrated. It is important to know that the charge is not fully on one nitrogen.

Comparison of N(1s) photoelectron spectra for inosine and 7-methyl inosine. [L. D. Hulett and T. A. Carlson, unpublished data.]
One typical application where surface composition is assessed.

ESCA spectra of MoO$_3$ versus MoS$_2$: the peak at ca. 226 eV in the MoS$_2$ spectrum is due to the sulfur 2s line.

The molybdenum 3d spectra of a fresh and used desulfurization catalyst: the spectrum of the used catalyst exhibits both oxide and sulfide species.
An example of a research study, utilising the surface sensitivity and characteristic chemical signature capabilities of XPS.

Photoemission spectra of the Pb 5d core level, taken on PbO (top, dashed line) and on a freshly cleaned YBaCuO surface progressively covered by Pb overlayers of increasing thickness. The nominal thickness is shown for each spectrum.
Similar study

Photoelectron spectra of the Bi5d region. From top: Clean Bi$_2$CaSr$_2$Cu$_2$O$_{8}$, 1 Å Cu overlay deposited and measured on a cold crystal (approx 100 K), 1 Å Cu on RT crystal, 6 Å Cu RT, 24 Å Cu RT and at bottom 24 Å Cu RT but with 60° angle of electron emission (surface sensitive). The intensity of the top spectrum, the clean crystal, has been reduced with a factor of 2 while the bottom spectra, 6 Å to 24 Å Cu, are multiplied by 2.
Photoelectron normal emission spectra of the S region. From top: Clean Bi$_2$CaSr$_2$Cu$_{2-x}$O$_y$, 1 Å Cu overlayer on cold crystal, 1 Å Cu on hot crystal, Cu RT, and at bottom 24 Å Cu RT spectrum. The intensity of the 6 Å Cu spectrum, second from bottom, has been multiplied by 2 while the 24 Å Cu, bottom spectrum, has been multiplied by 4.
A catalysis application

ESCA spectra of a fresh, used, and spent charcoal-supported palladium catalyst.

ESCA spectra of a spent charcoal-supported palladium catalyst before and after ion etching.