

# XPS

## What you should know about X-ray photoelectron spectroscopy?

### Course Objectives:

- Learn physics principles of X-ray Photoelectron Spectroscopy (XPS).
- Learn about the analysis of surfaces with XPS and limitations of the technique.
- Learn approaches for qualitative and quantitative analysis of XPS data.
- Learn the types of problems that can be solved with XPS: examples.
- Advanced data analysis: coverage calculation, thin film thickness calculation, etc.

### Course Description:

XPS is widely used to determine the chemical composition of a surface (element concentrations, chemical states, lateral and depth distributions, etc.). Nowadays XPS has become a standard technique for the characterization of solid surface. The course will teach how and what information can be provided by XPS.

### Audience:

The lecture is orientated at a general audience: Scientists, engineers, students, and technicians who would like a detailed understanding of the use of XPS/ESCA for surface analysis.

### Instructor:

Dmitry Zemlyanov, Surface Science Application Scientist, Birck Nanotechnology Center, Purdue University.

### Total 2-Day Cost:

\$300 for academia  
\$500 for industry

Purdue Registration at: <http://bit.ly/n9tnoc>  
External Registration at: <http://bit.ly/qfaN7H>

### Day 1 (tentative):

*Introduction:* terminology, surfaces, types of surfaces.

*The Principles of XPS:* production of photoelectrons, electronic configuration of atoms and molecules, energy, spectra, peak labeling, Auger process, valence spectra, handbooks, books, surface sensitivity, information depth and attenuation length, spin-orbit splitting, chemical shift, plasmons, multiplet splitting, shake-up. Handbooks and helpful references will be recommended.

*Instrumentation:* X-ray anodes, monochromatic radiation, electron energy analyzers, energy resolution, spectrum acquisition, energy scale calibration, electron detectors, small area analysis, imaging XPS, vacuum system, samples and sample handling.

### Day 2 (tentative):

*Artifacts:* radioactive and thermal damage, charging, methods for charge control, ghost peaks.

*Qualitative Analysis:* identification of elements, changing x-ray sources, charging correction and reference lines, interpretation of chemical shift, relaxation effects, Auger parameter, peak widths, line-shapes.

*Quantitative Analysis and Data Processing:* sensitivity factors, ionization cross section, asymmetry parameter, analyzer transmission, intensities, background subtraction, satellite subtraction, detection limit, effect of thin overlayers, peak area, lineshapes, curve fitting, deconvolution.

*Depth Profiling:* non-destructive and destructive methods, angle resolved XPS, elastic and inelastic scattering, sputtering, sputtering depth calibration.

*Applications:* some further examples of applications of XPS.

*Advance Data Processing:* coverage calculation, thin film thickness calculation.