Short Course: ***X-Ray Photoelectron Spectroscopy (XPS/ESCA) (2- days)***

Instructor: The courses are being taught by John T. Grant, who has over 40 years experience in surface analysis, and who has been teaching such courses for many years. He had been a Distinguished Research Scientist at the University of Dayton for over 30 years. He is now a consultant in surface science. He is co-editor of the book: Surface Analysis by Auger and X-ray Photoelectron Spectroscopy.

Duration: 2 Days

Who Should Attend? Scientists, engineers, technicians, and students, who would like a detailed understanding of the principles and uses of XPS/ESCA for surface analysis and depth profiling.

Description and Objectives: XPS is used to determine the atoms present at a surface and their concentrations, chemistry, and lateral and depth distributions. This course is designed for scientists, engineers, technicians, and students, who would like a detailed understanding of the principles and uses of XPS/ESCA for surface analysis and depth profiling. Topics include the principles of XPS, instrumentation, qualitative analysis, quantitative analysis, artifacts, data acquisition and processing, imaging, and depth profiling.

Course Materials: Printed copy of all slides

Content:

Day 1:

- Introduction – terminology, surfaces, types of surfaces.

- The principles of XPS – production of photoelectrons, peak labeling, electronic configuration of atoms, atoms, molecules, solids, binding energy, spectra, Auger process, valence spectra, surface sensitivity, information depth, sample handling, spin-orbit splitting, chemical shift, plasmons, multiplet splitting, shake-up.

- • Instrumentation – dual anode, Bremsstrahlung, monochromatic source, electron energy analyzers, spectrum acquisition, energy resolution, scattering in analyzers, electron detectors, pulse counting, position sensitive detectors, small area analysis, area location, imaging XPS, methods, equipment and examples, vacuum system, samples, energy scale calibration.

Day 2:

- Qualitative analysis – identification of elements, changing x-ray sources, charging, interpretation of chemical shift, relaxation effects, Auger parameter, peak widths, lineshapes.

- Quantitative analysis – sensitivity factors, ionization cross section, asymmetry parameter, analyzer transmission, reference spectra, intensities, background subtraction, detection limit, effect of thin overlayers.

- Artifacts – x-ray damage, charging, methods for charge control, ghost peaks.

- Data acquisition and processing – processing data, background subtraction, satellite subtraction, peak area, lineshapes, curve fitting, deconvolution.

- Depth profiling – non-destructive and destructive methods, angle resolved XPS, diffraction,

elastic scattering, thickogram, inelastic loss method, sputtering, depth calibration.

- Applications – some further examples of applications of XPS.
- Instrument selection and summary – factors to consider, general summary.