



Technique	Key Uses	Key Benefits	Equipment Highlights
<p>X-Ray Photoelectron Spectroscopy (XPS)</p> <p>XPS is also known as Electron Spectroscopy for Chemical Analysis (ESCA)</p>	<ul style="list-style-type: none"> • Surface analysis of solids for all elements except H • Readily obtainable chemical state information • Thin film analysis • Detection limits on the order of ~0.01 at. % 	<ul style="list-style-type: none"> • Suitable for all types of solids in virtually any form • Low risk of damage on even radiation-sensitive materials • Straightforward quantitative analysis • Imaging capabilities with spatial resolution $\leq 10 \mu\text{m}$ • Compositional depth profiles in instruments equipped with ion guns 	<ul style="list-style-type: none"> • VG Scientific ESCALAB 220i-XL Imaging-XPS with an X-ray monochromator and twin-anode sources • High-performance Schottky field-emission electron gun for auxiliary SAM, SEM and EELS analyses • UHV pocket chamber for heating and cooling, controlled gas exposure, and ion etching of radioactive materials • Unique fracture stage for retention and analysis of both fracture surfaces • Instrument housed in Class B Radioisotope Laboratory and fitted with appropriate shielding for studies of highly radioactive materials
<p>X-Ray Diffraction</p>	<ul style="list-style-type: none"> • Texture, line-broadening, residual stress and powder analyses for both non-active and radioactive materials 	<ul style="list-style-type: none"> • Precise measurement and analysis • Extensive specimen preparation capabilities for non-active and radioactive materials 	<ul style="list-style-type: none"> • Rigaku 12kW rotating anode diffractometer, with a Cu rotating anode target • Philips texture goniometer with Ni-filtered $\text{CuK}\alpha$ radiation for generating full pole texture plots • A $\theta/2\theta$ goniometer with a graphite monochromator, used on a second port for line-broadening or powder analysis
<p>Surface Metrology</p>	<ul style="list-style-type: none"> • Precise measurement of surface texture—roughness, waviness and BAC parameters, for non-active materials 	<ul style="list-style-type: none"> • Precise measurement and analysis of manufactured components • Fretting analysis of tested fuel bundles and fuel channels • Characterization of fuel bundles 	<ul style="list-style-type: none"> • Taylor Hobson Form Talysurf Mark I, equipped with METREX “profileView SLR” software for on-screen analysis
<p>Remote Optical Microscopy for Post Irradiation Examination</p>	<ul style="list-style-type: none"> • Surface microscopy of metals and ceramics 	<ul style="list-style-type: none"> • Microscopic examination of highly radioactive materials at magnifications from 16X to 1250X • Image analysis of layers/coatings and volume fraction measurements • Digital imaging and archiving (images can also be captured on 4x5 inch Polaroid film, 35 mm film, videotape, or digitally) 	<ul style="list-style-type: none"> • A Leica Telatom 4 and a Reichert Telatom with radiation-resistant optical components • Bright field, polarized light, differential interference contrast, and oblique lighting capabilities • Microhardness tester • Computer-controlled scanning stage