Surface and Bulk Analysis Techniques

Abbrev-iation	Technique	Primary Beam	Dectected Specie	Spot Diameter	Analysis Depth	Elements	Specificity	Sensitiviy	Comments
AES	Auger Electron Spectroscopy	Electrons	Auger-Electrons	500nm	<5nm	Li to U	Good	0.3-1.0%	Depth profiling by Argon milling.
EMP	Electron Microprobe			2.5um				100ppm	
FTIR	Fourier Transform Infared Spectroscopy	IR Photons	IR Photons					<1ppb	Epitaxial thickness from 1 to 200um. P,As,Sb,B,Al
IIXF	Ion Induced X-Ray Fluorescence			1mm				1ppm	Ga,In,C and O concentrations in Silicon
IMMA	Ion Microprobe Mass Analysis			250um				0.01ppm	Similar to SIMS except with a small rastered Ion Beam (2.5-10um).
ISS	Ion Scattering Spectroscopy			500um				1%	
LIMS	Laser Ion Mass Spectroscopy	Laser	Ions	1-2um		H to U		100ppm	
NAA	Neutron Activation Analysis	Nuetrons	or emission					<1ppb	Au,C,O,B,Na,Al,Fe,Zn,As,Ag in Silicon
NRA	Nuclear Reaction Analysis	Ions			10nm	Comments			H,He,Li,Be,B,C,N,O,F,Al
PIXE	Particle Induced X-Ray Emission	Ions	X-Ray		10nm	Na to U			
PL	Photoluminescence Spectroscopy	Photons	Photons			Comments		<1ppb	B,P,Al,As,N in Silicon
RIS	Resonance Ionization Spectroscopy	Ions	Ions	1um	<5nm	>Li, no He,Ne	Excellent	1ppb	Uses a tuned laser to ionize specific emitted ions.
RBS	Rutherford Backscattering Spectroscopy	Ions	Ions	100um-1mm	2.5-20um	Li to U	Good	100ppm	Provides depth and elemental composition information. Does not require standards and can also detect crystalline imperfections.
SAM	Scanning Auger Microscopy			500nm	<5nm	Li to U		1%	Depth profiling by Argon milling.
SEM	Scanning Electron Microscope	Electrons	Electrons	10nm	~1um			NA	
SIMS	Secondary Ion Mass Spectroscopy	Ions	Ions	1-200um	~0.5nm	H to U	Very Good	0.1ppm	Depth profiles by sputtering. Larger beam diameters have better sensitivity than small beam diameters.
TEM	Transmission Electron Microscopy				50nm				Require very thin sample. Provides excellent morphology and crystallinity information.
XES	X-Ray Emission Spectroscopy	Electrons	X-Ray	1-3um	1-5um	Be to U		0.3-1.0%	EDX - Energy dispersive X-ray - all peaks at once. Limited resolution for closely spaced peaks. WDX - Wavelength dispersive X-ray - one peak at a time. Better peak to peak resolution but slower.
XPS	X-Ray Photoelectron Spectroscopy	X-Ray	Photo-Electrons	150um	<5nm	Li to U	Good	0.1-1.0%	Also known as ESCA. Depth profiling by Argon milling. Provides chemical bond information.
XRF	X-Ray Fluorescence Spectroscopy	X-Ray	X-Ray	>150um				1ppm	
XRT	X-Ray Topography	X-Ray	X-Ray						Shows crystalline defects with minimum resolution of 1um.