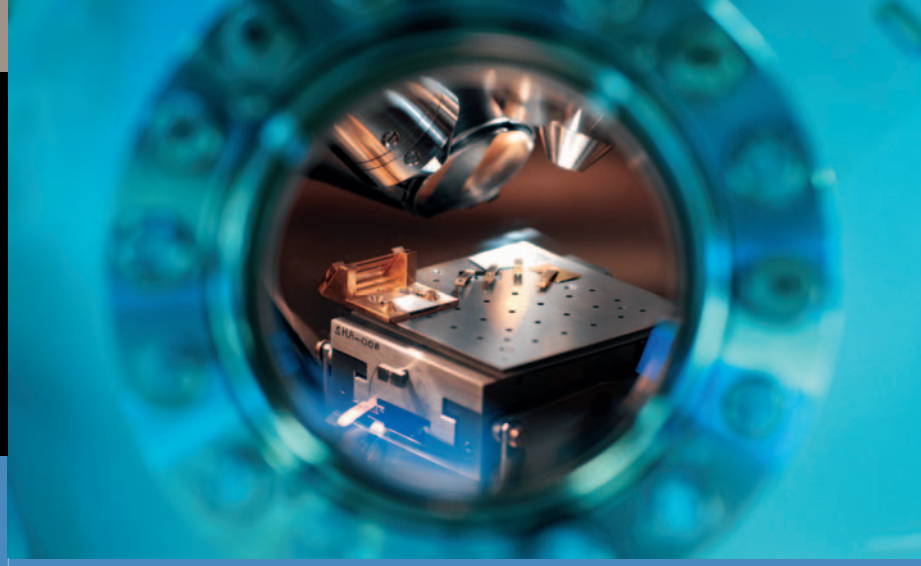
Thermo Scientific Theta Probe



Small Spot XPS Spectrometer with Parallel ARXPS Capability

Polymers

Semiconductor

Self Assembled Monolayers

Surface Modification

The Thermo Scientific Theta Probe is a major advance in surface and ultra-thin film analysis, featuring small spot XPS and a unique parallel angle-resolved XPS capability suitable for applications such as:

- Ultra-thin films
- High-k dielectrics
- Surface modification of insulators
- Self assembled monolayers
- Modified polymers

Theta Probe combines ease-of-use with rapid sample throughput.

- Fast snapshot spectra
- Maximum sensitivity in small area XPS
- Unique parallel angle resolved XPS (PARXPS) for fast data acquisition
- Chemical state and depth information
- Non-destructive depth analysis
- Overhead sample viewing for fast and accurate sample alignment
- Automated multi-sample analysis

A New Dimension in Surface Analysis

Theta Probe

Theta Probe is an exceptionally easy-to-use problem-solving tool. It delivers:

- Quantitative surface and thin film analysis
- Small area analysis with high sensitivity
- Non-destructive analysis of ultra-thin films (<10 nm)
- Sputter depth profiles
- Maps of
  - *Elemental distribution*
  - *Chemical state distribution*
  - *Film thickness*
  - *Film uniformity*

Small Area XPS (SAXPS)

Theta Probe uses a microfocusing monochromator for source-defined SAXPS, making it as simple as large area XPS

- User-selectable spot size from 15 µm to 400 µm
- Source-defined SAXPS provides maximum sensitivity especially at the smallest areas
- Moveable anode for maximum lifetime
- Effective charge compensation

Parallel Angle-resolved XPS

For advanced thin film analysis Parallel Angle Resolved XPS (PARXPS) has many advantages

- PARXPS can be used for small areas, large samples and within images and depth profiles
- PARXPS is faster than the traditional method involving sample tilting
- The analysis area remains constant, independent of electron emission angle
- The energy resolution is constant over all angles because the whole of the X-ray spot is within the field of view of the spectrometer
- Mapping can be combined with ARXPS to determine the uniformity of ultra-thin layers

Measurement

PARXPS is a powerful tool for non-destructive determination of:

- The sequence of layers in an ultra-thin film
- Thickness of the layers, including buried layers
- The concentration depth profile through the layers
- Uniformity of thickness, composition and distribution of material within the layers

Avantage

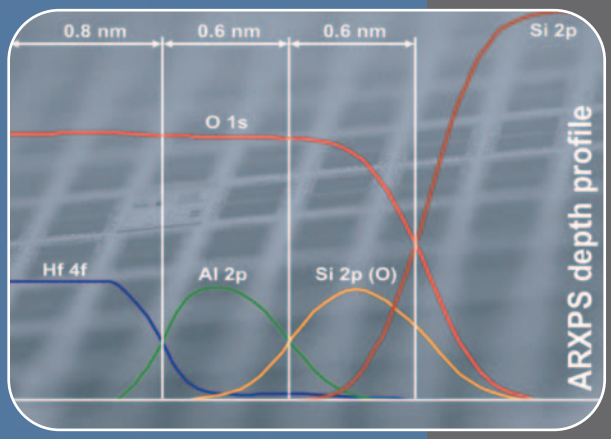
The Thermo Scientific *Avantage* data acquisition and processing software incorporates all the features necessary to extract the maximum amount of information from the analysis and has a comprehensive set of data and image processing tools including:

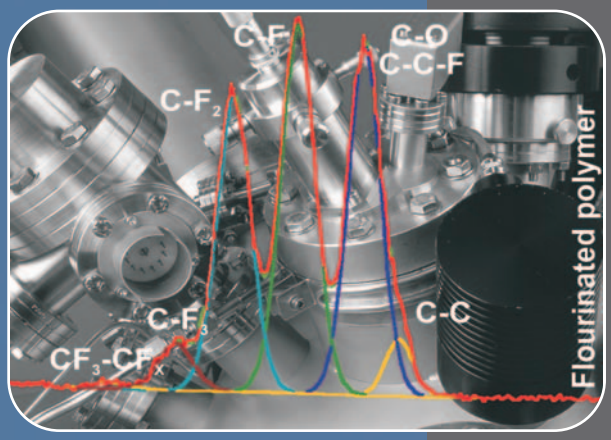
- Linear, Shirley and Tougaard background subtraction
- Peak identification
- Quantification
- Peak fitting
- Non-linear least squares fitting
- Multi-dimensional data display
- PARXPS tools
  - *Relative depth plotting*
  - *Multiple overlayer thickness calculator*
  - *Depth profile generator*

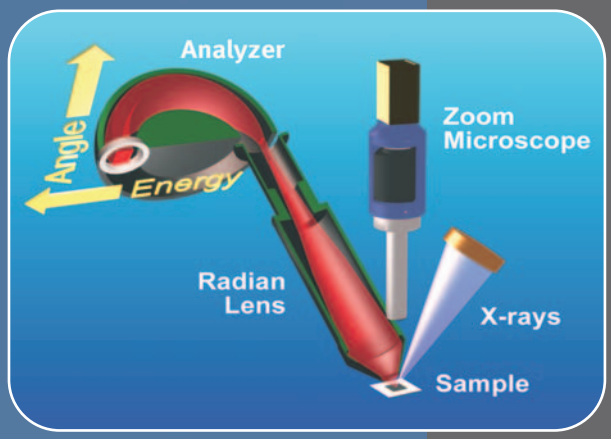
Sample Handling

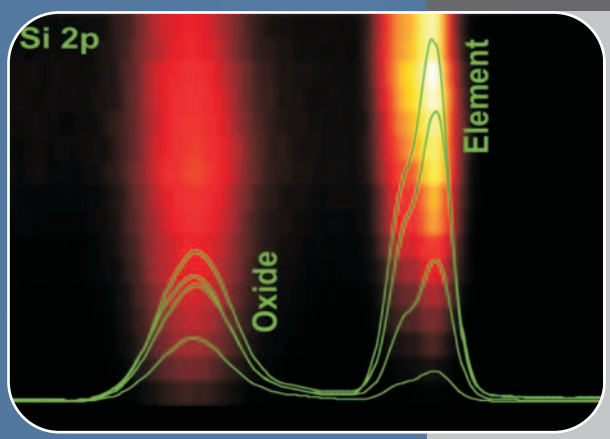
Theta Probe is equipped with versatile and precise sample handling features.

- Stage movement 70 x 70 x 25 mm for large samples or a large number of small samples
- Multi-sample unattended operation for maximum productivity
- CCD camera and zoom microscope aligned with the analysis position for fast and accurate sample alignment
- Overhead optical view allows the stage position to be controlled from the optical image
- Optional 8-sample rotation holder









Theta Probe

Electron Analyzer

- Double-focusing full 180° spherical sector Analyzer
- Multi-element electrostatic RADIAN input lens for spectroscopy
- Two-dimensional, multi-channel spectroscopic detector for spectroscopy and PARXPS

Microfocused Monochromated X-ray Source

- 250 mm Rowland circle monochromator
- Microfocused electron gun and multi-position aluminum anode X-ray source
- Thermostatically controlled quartz crystal and crystal manipulator
- Spot sizes down to 15 µm

Combined Low-energy Electron/Ion Flood Gun

- Charge neutralization
- Flood gun assembly incorporating electrostatic deflection for precise alignment
- Low energy-spread, high brightness electron source

Ion Gun

- Sample cleaning
- Depth profiling
- Beam scanning and video
- Differential pumping

Sample Viewing

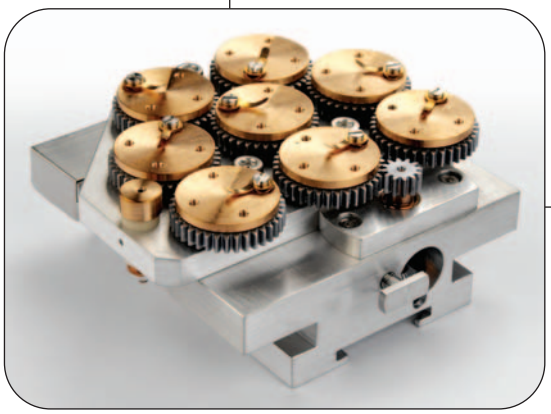
- X-ray shielded viewport
- Zoom microscope sample alignment facility with CCD camera
- Multiple light sources

Fast Entry Chamber

- UHV compatible sample transfer mechanism
- Fully safety interlocked pneumatic 98 mm gate valve to analysis chamber
- Turbomolecular pump and rotary backing pump

5-axis Sample Stage

- High precision, automated sample stage with internal stepper motors
- Stage controller with trackball and joystick control interfaced to the *Avantage* data system
- Maximum analysis area 70 mm x 70 mm
- Maximum sample thickness 25 mm



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