Thermo Scientific Theta Probe
Surface Analysis System

Versatile XPS system

for ultra-thin film analysis

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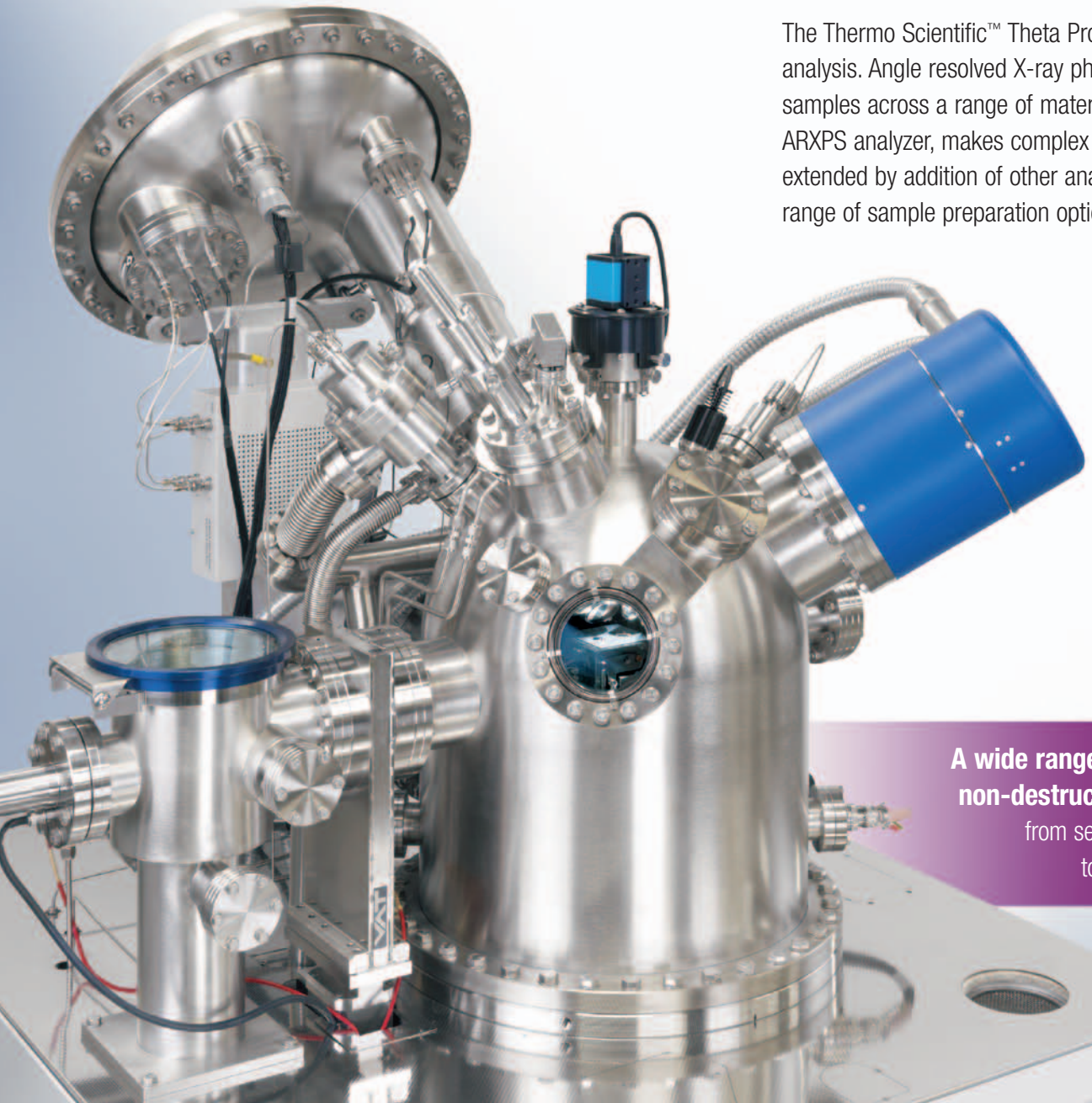
Thermo SCIENTIFIC

Thermo Scientific Theta Probe

Powerful tools for ultra thin film analysis



The Thermo Scientific™ Theta Probe is a high performance XPS system designed for ultra-thin film analysis. Angle resolved X-ray photoelectron spectroscopy is the perfect technique for measuring samples across a range of materials. Theta Probe, with a micro-focused X-ray source and parallel ARXPS analyzer, makes complex thin film measurements simple and intuitive. Theta Probe can be extended by addition of other analysis techniques, such as UV photoelectron spectroscopy, and a range of sample preparation options.

- **Parallel ARXPS for ultra-thin film measurements without tilting**
- **Small spot X-ray source for small feature analysis**
- **Chemical state imaging**
- **Overhead sample alignment with co-axial and off-axial lighting**
- **Large sample handling**
- **Ion source for depth profiling**
- **Fully featured Thermo Scientific™ Avantage™ software for instrument control, data acquisition, data processing and reporting**

A wide range of applications exist that require non-destructive chemical characterization of ultra-thin layers
from semiconductor devices and graphene-based electronics,
to medical devices and self-assembled monolayers.

Parallel ARXPS

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

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

Small Area Spectroscopy

Theta Probe uses a microfocusing monochromator for source-defined SAXPS, making it as simple as large area XPS. The microfocused X-ray source allows easy acquisition of chemical state images of the surface. When combined with PARXPS this can be used to create images of the distribution of chemistries in ultra-thin films, for example high-k dielectrics or self-assembled monolayers.

- User-selectable spot size from 15 µm to 400 µm
- Source-defined SAXPS provides maximum sensitivity, the benefits increase as the area becomes smaller
- Moveable anode to maximise consumable lifetimes
- Dual-beam charge compensation for insulator analysis

Avantage Software

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
- Principal Components Analysis
- Multi-dimensional data display
- PARXPS tools
  - – Relative depth plotting
  - – Multiple overlayer thickness calculator

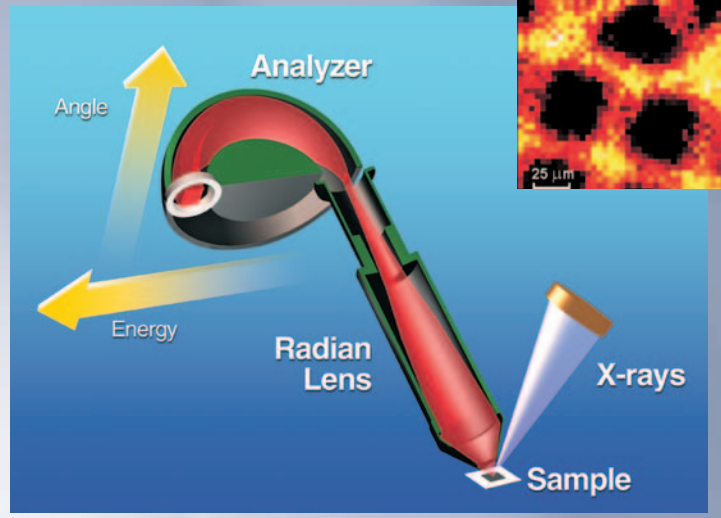
Depth Profiling

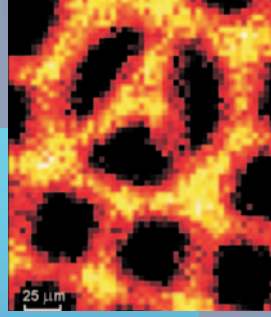
- Theta Probe comes equipped with the standard ion source or the optional MAGCIS source, a dual mode monatomic and gas cluster ion gun
- Automated gas handling ensures excellent performance and experimental reproducibility

Sample Navigation and Handling

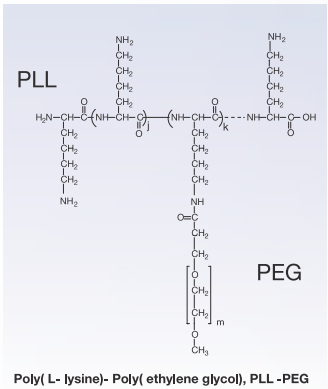
Theta Probe is equipped with versatile and precise sample handling features.

- Stage movement 70 × 70 × 25 mm for large samples or a large number of small samples
- Multi-sample unattended operation for maximum productivity
- Optical system for live sample view 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

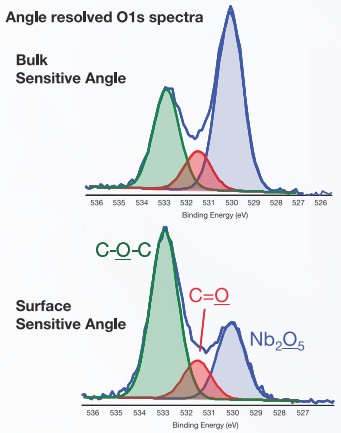


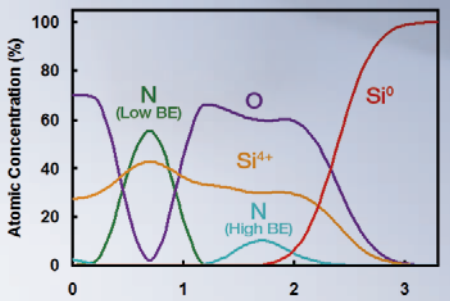


Protein Resistant Biomaterials - PLL-PEG on Nb_2O_5



Poly(L- lysine)- Poly(ethylene glycol), PLL -PEG





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
- 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
- REELS capability

Ion Gun

- Sample cleaning
- Depth profiling
- Computer controlled fixed-rate leak valve for inert gas admission
- Ion scattering spectroscopy

Sample Viewing

- Digital camera aligned normal to the sample stage for precise alignment
- Large area chamber viewing digital camera, with two separate mounting locations.
- Co-axial and off-axis light sources

5-axis Sample Stage

- High precision, automated sample stage with internal stepper motors
- Full stage control via the Avantage data system
- Maximum sample size 90 × 90 mm (maximum analysis area 70 × 70 mm)
- Maximum sample thickness 25 mm

Options

Twin Anode X-ray Source

- Dual anode non-monochromated X-ray source

Field Emission Electron Source

- FEG 1000 electron source for Auger electron spectroscopy and SEM
- Scintillator/photomultiplier detector for SEM imaging
- Vacuum system vibration isolation

UPS

- High intensity UV lamp with two stage differential pumping and manifolds
- Helium gas admission system with two fixed-rate high precision leak valves

Thermo Scientific™ MAGCIS™ (Monatomic and Gas Cluster Ion Source)

- Dual mode ion source
- Cluster mode for profiling “soft” materials such as polymers and gentle cleaning of samples prior to XPS
- Monatomic mode for standard ion gun operation

Platter Camera

- Desktop assembly for capturing calibrated images of sample holder prior to loading into system
- Single-click Avantage datasystem interface for image capture and display

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