Powerful instrument operation and data processing

for XPS surface analysis

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and Related Solutions

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Thermo
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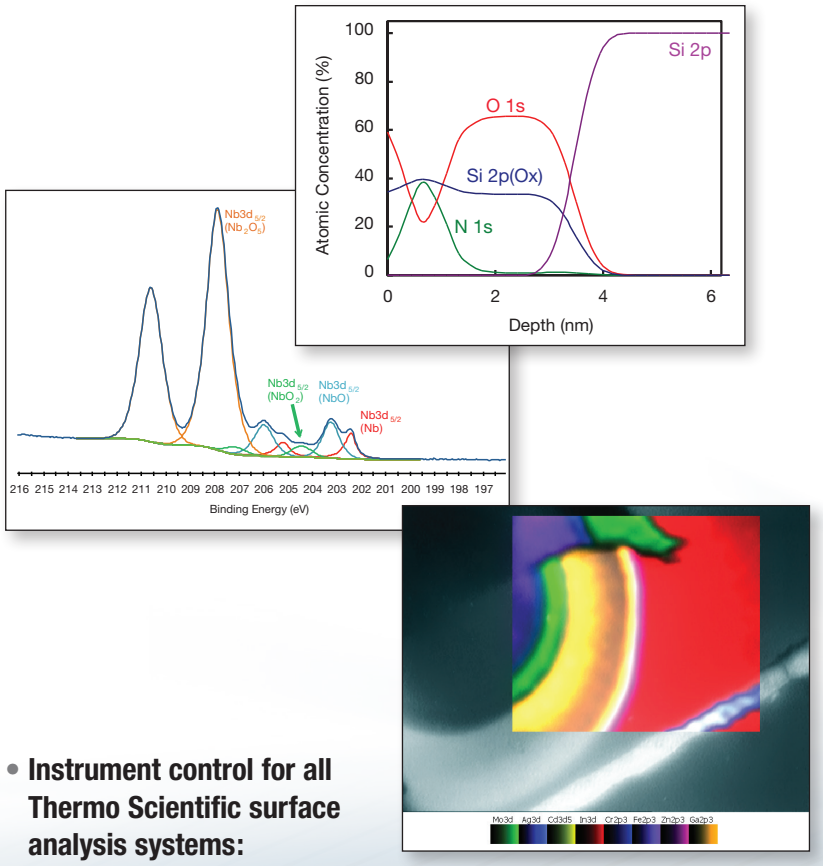
Avantage Software

The premier software for surface analysis

The most crucial component of a modern XPS instrument is its software, which handles all aspects of operation, data interpretation and reporting.

All Thermo Scientific™ XPS systems use Thermo Scientific™ Avantage™ software for instrument control, data processing, and reporting. Whether working in a dedicated research lab or in a multi-user environment, analysts of all abilities can rely on the flexibility, feature-set, and intuitive operation of Avantage software to enable to obtain the maximum information from their samples.



- **Instrument control for all Thermo Scientific surface analysis systems:**
  - Thermo Scientific™ K-Alpha™ XPS System
  - Thermo Scientific™ ESCALAB™ 250Xi XPS Microprobe
  - Thermo Scientific™ Theta Probe™ XPS System
- **Fully-flexible experiment design**
- **Automated data acquisition including data processing functions and reporting**
- **Comprehensive libraries, references and intelligent algorithms for data interpretation**
- **Advanced data reduction tools**
- **Flexible reporting functions**

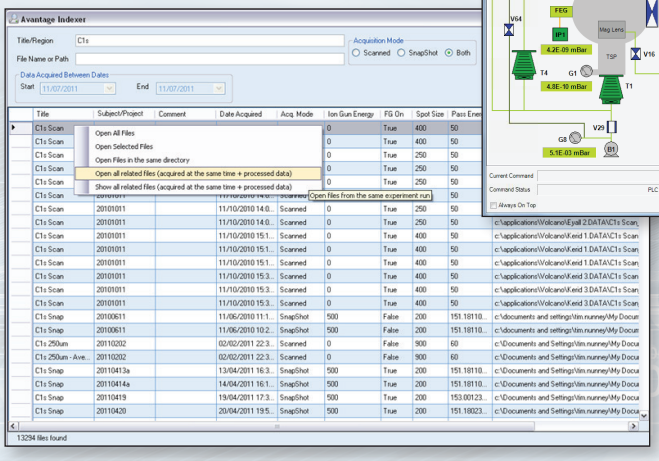
Control

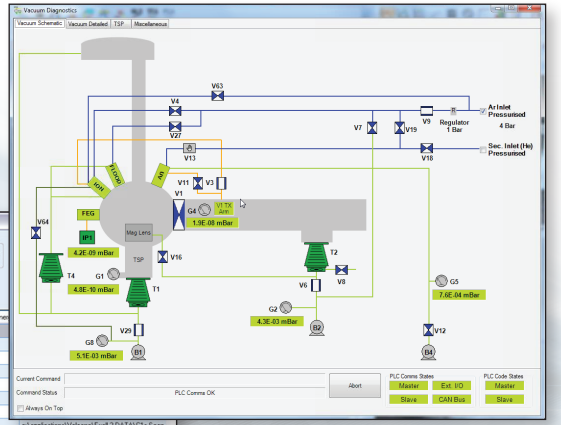
Full system control, calibration, and traceability

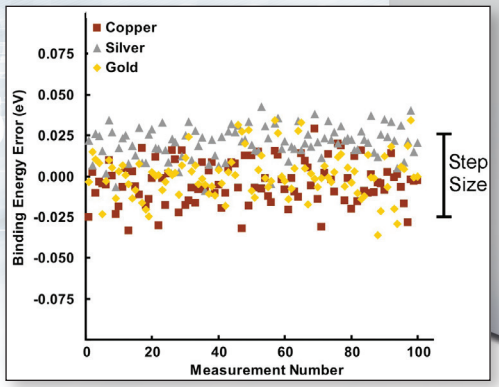
From the moment samples are loaded into the system, Avantage software handles all the instrument operations to prepare for data collection.

The software also monitors all system parameters, storing the data to keep a record of the performance of the instrument.

In addition, Avantage software can automatically calibrate system components to ensure that crucial factors such as the accuracy of the energy scale are known and logged over time.





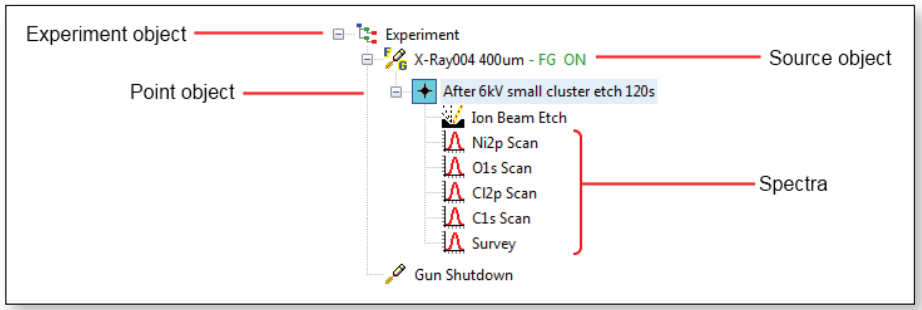


Acquire

Complex analyses, minimal effort

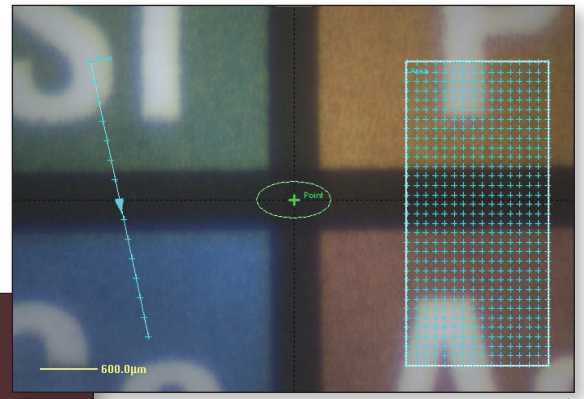
Avantage software removes the barriers to getting the best possible data from your materials. Whether performing standard point analyses, collecting XPS images, or depth profiling, Avantage guides the operator to seamlessly build up the correct experimental protocol. Users can tailor the experiment parameters to their specific needs, and store commonly used set-ups in libraries to facilitate common experiments.

Sensible default parameters, intelligent scan optimization, and automated analysis routines even allow the system to make decisions during acquisition to progress through the analysis process all the way through to publishing a report.

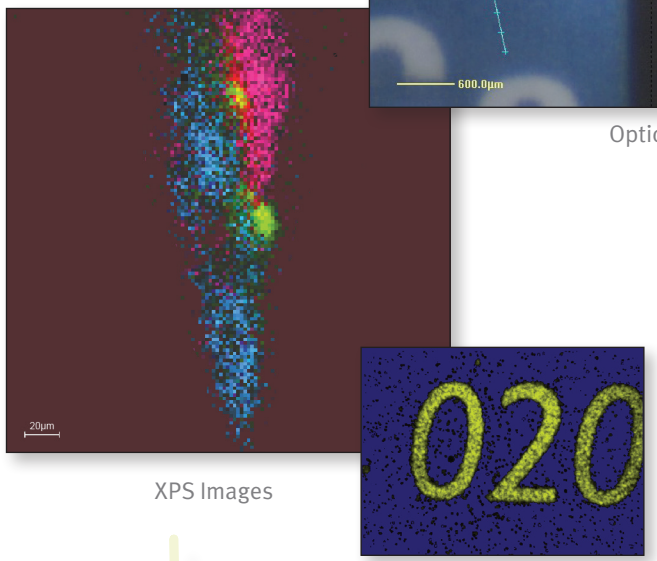


Experiment Tree

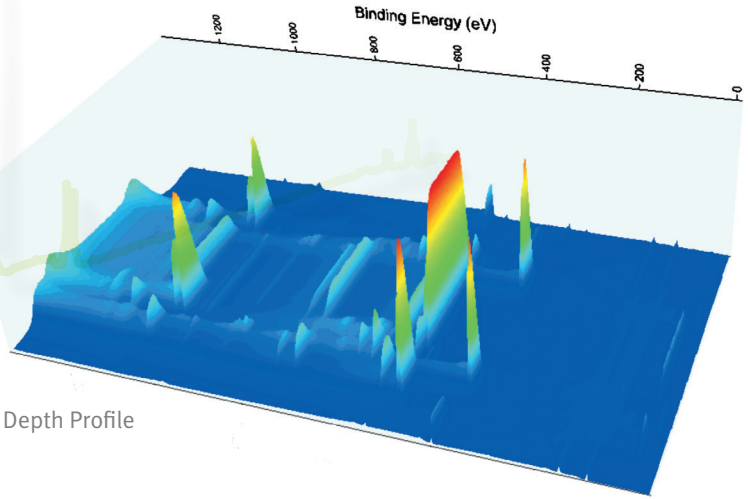
The center of the acquisition process is the experiment tree. This is where experiments are built-up using simple, modular components.



Optical Image



XPS Images

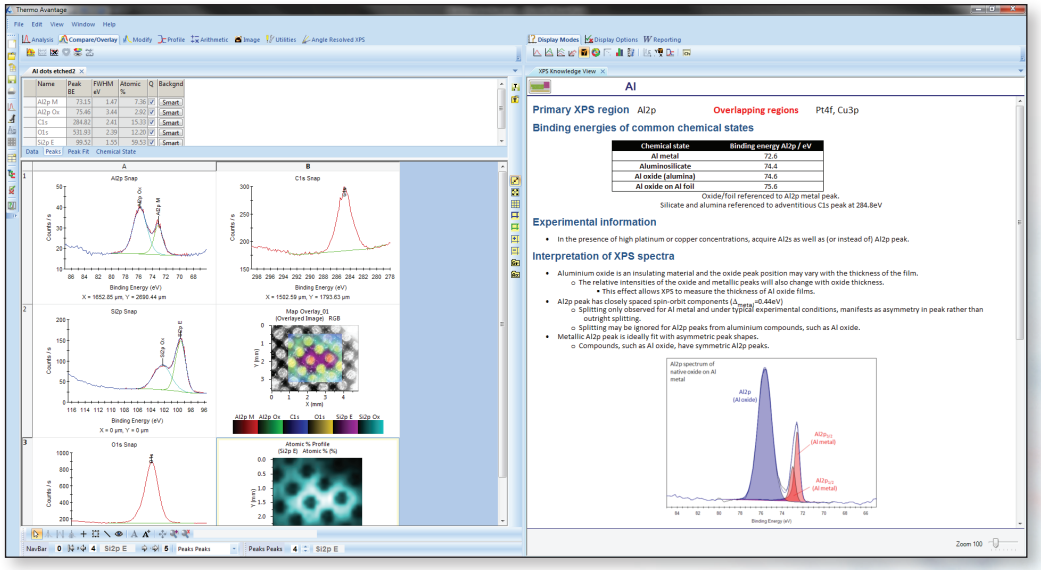


Depth Profile

Understand

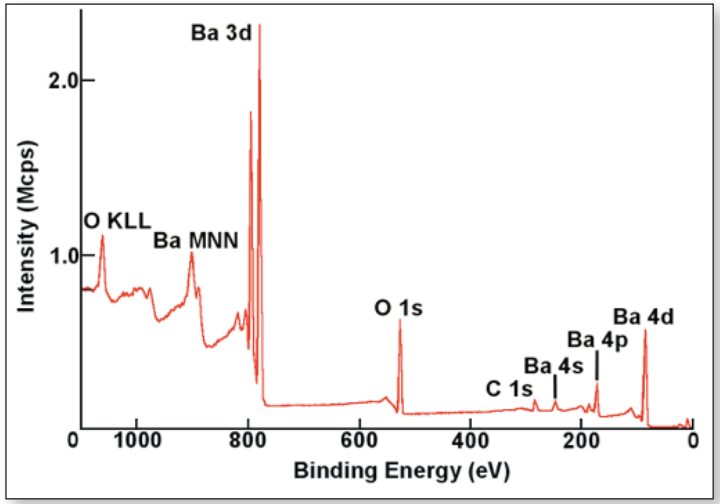
Built-in intelligence, expert analysis

Collecting the data is only half the story. Avantage software is ready to assist in interpreting spectra and provide a rich understanding of the output of your XPS instrument. From interactive references to intelligent algorithms, Avantage has the tools and the workflow to guide you quickly to answers.



Knowledge Viewer

The Knowledge Viewer contains a store of XPS information to offer advice on experimental considerations, and spectral interpretation. The Knowledge Viewer links to a database of spectra, which can be opened in Avantage software, and used to help with peak fitting and chemical state quantification.



Automatic Identification

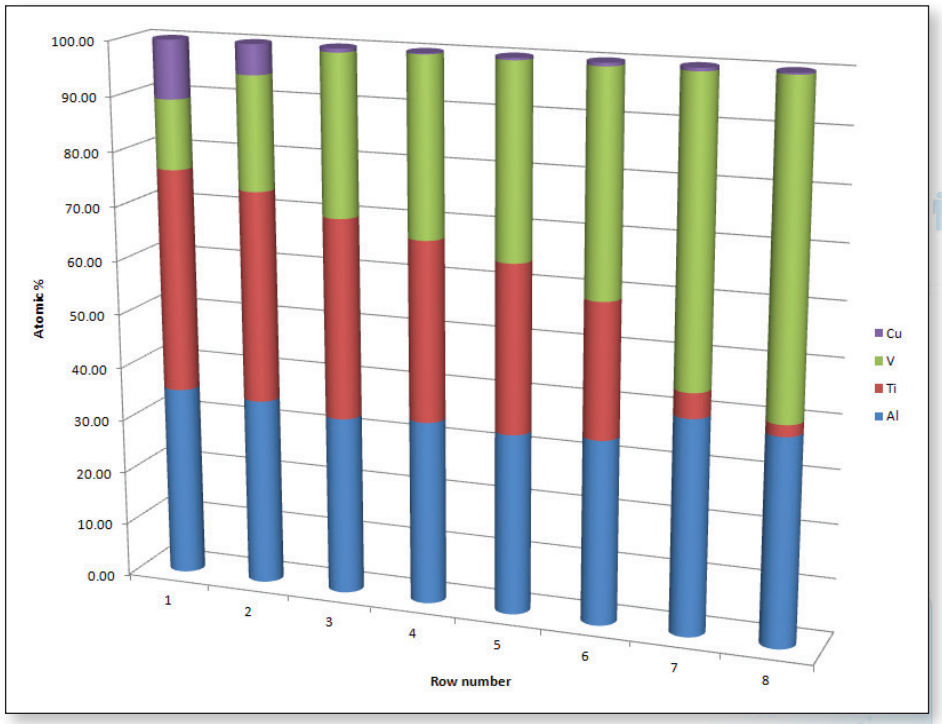
Intelligent spectral interpretation algorithms can assess your data to quantify the elemental composition, and assess the likely chemical states present at the surface.

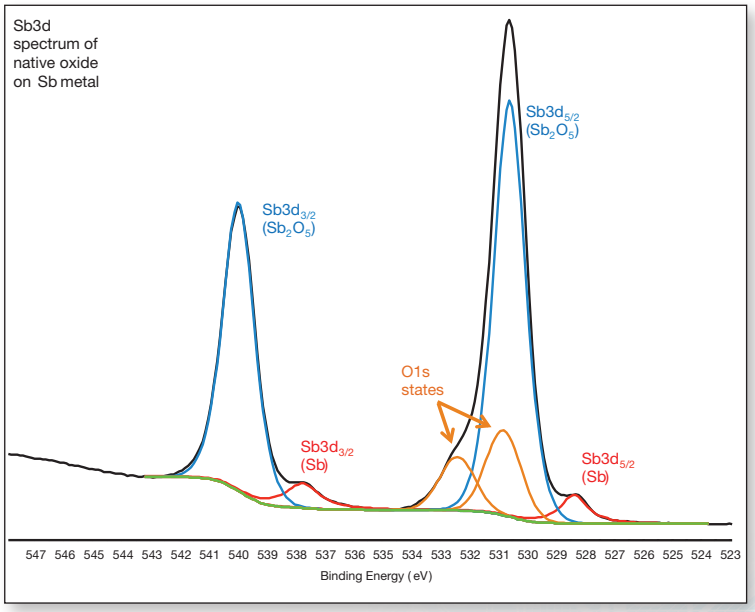
Analyze

Precise results, produced accurately and efficiently

Rapidly move from data to results with the comprehensive selection of processing tools.

Including essential features to quantify individual spectra and powerful peak deconvolution routines, Avantage software enables the user to get the key chemical information from their samples with ease.





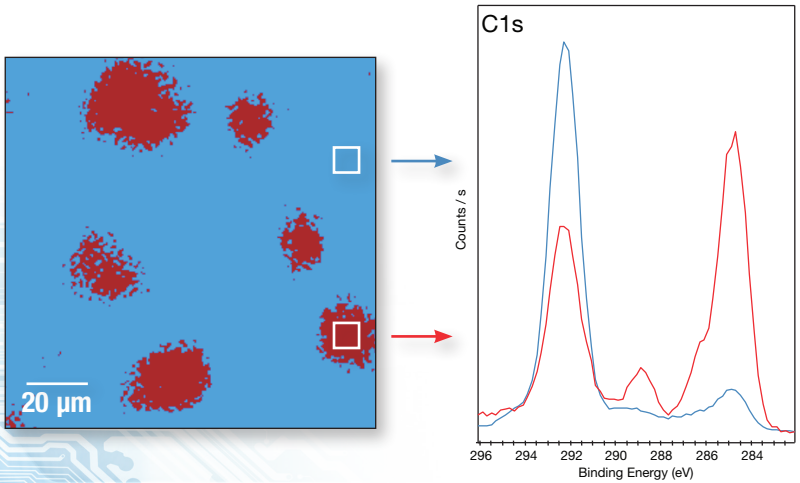
Peak Deconvolution

In order to quantify chemical states from overlapping peaks it is necessary to fit the data with synthetic peak shapes. With a single button press, add linked doublets to resolve overlapping chemical states with ease. Avantage software allows control of background shapes, peak shapes, and fitting algorithms to ensure that results are as accurate as possible.

Image

Identify features, locate chemistries

The rich imaging datasets created by Thermo Scientific XPS instruments, where each pixel corresponds to an array of spectra, need advanced tools to visualize the complete picture. Avantage software has everything required to create elemental and chemical state images, perform phase analyses, and extract spectra from small features.

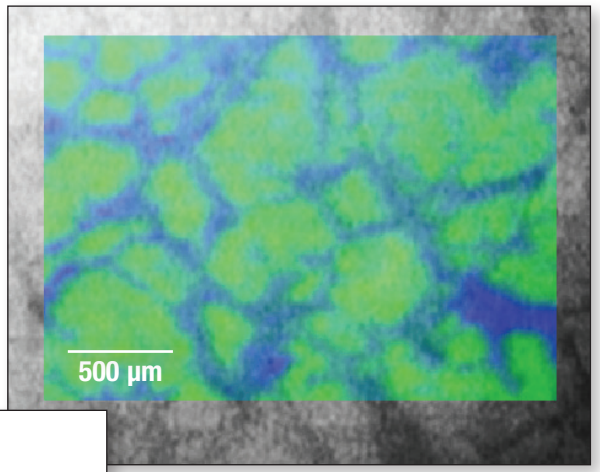


Retrospective Spectroscopy

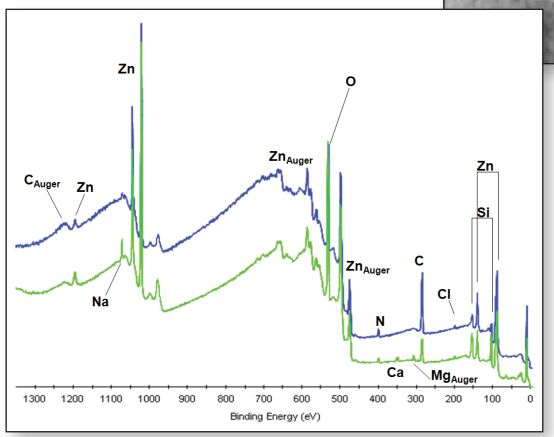
Select areas of interest on an XPS image. Avantage software will then average the spectra from each pixel and display the results for each region or element. View spectra from features smaller than 7 µm in size from ESCALAB 250Xi parallel images.

Component and Phase Analysis

Image data can be analyzed using principal component analysis to extract spectral components for fitting chemical states, or to identify phases on the surface. Phase analysis creates images with elemental or chemical state quantification and average spectra of each phase, ideal for reporting the results of XPS image analysis.



Phase map of PPZnOAzide

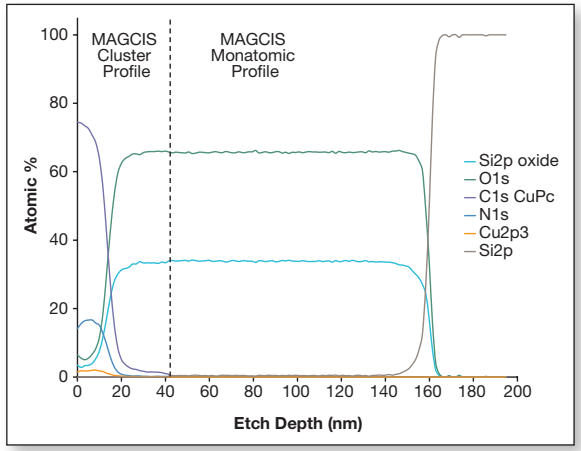


Survey spectra from each phase

Profile

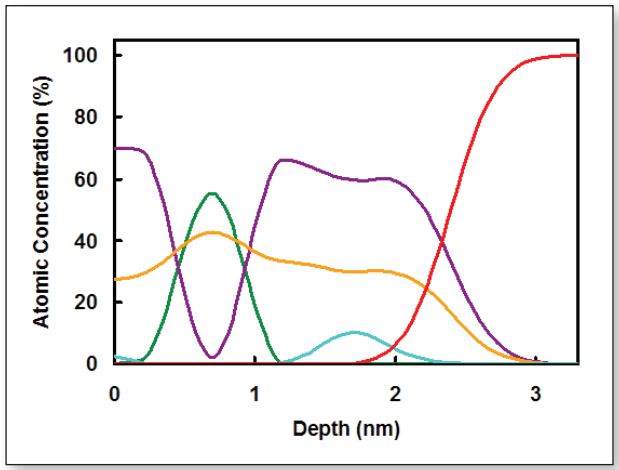
Understanding thin and ultra-thin films, layer by layer

X-ray photoelectron spectroscopy plays a key role in understanding layer chemistries. X-ray photoelectron spectroscopy plays a key role in understanding layer chemistries. Use a standard ion gun or the advanced Thermo Scientific™ MAGCIS™ dual mode ion source to collect sputter depth profiles, or to collect angle-resolved XPS data to investigate ultra-thin films. Avantage software makes data collection and processing, simple, fast and effective.



Depth Profiles

Avantage software can display profiles during acquisition, allowing changes to sputter parameters to be made on the fly. Coupled with remote access to the instrument PC, this creates the ability to get every profile, even on unknown samples, right first time. Extensive tools to peak fit data accurately at every level of a profile, and correlate etch times to depths allow layer chemistries to be located and measured.



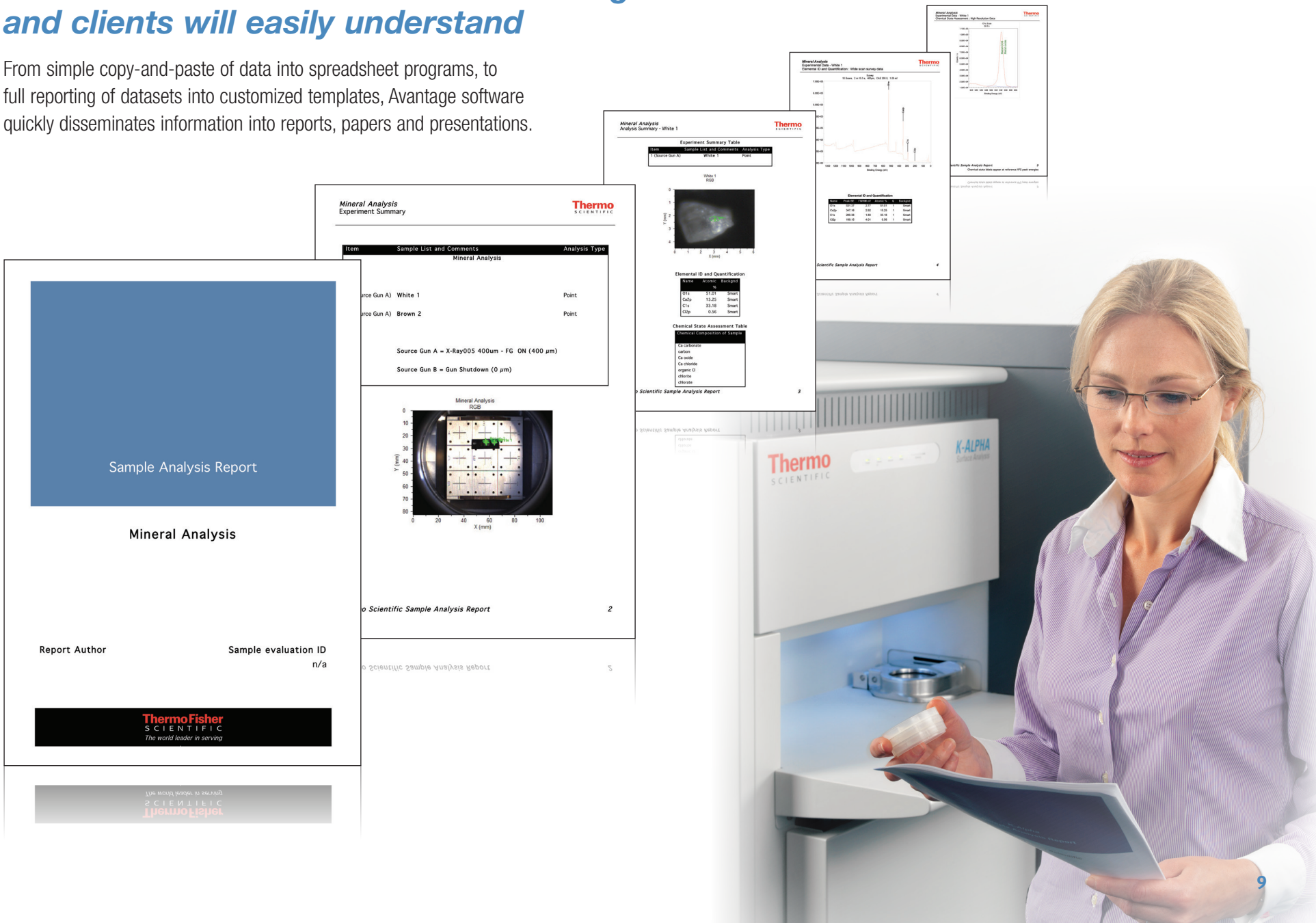
ARXPS

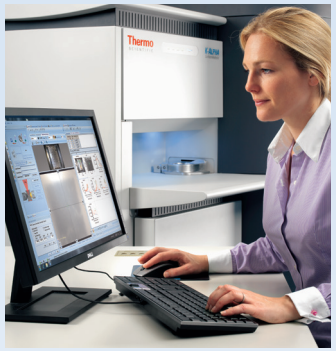
Whether using an ESCALAB 250Xi or a K-Alpha XPS system, or using the Theta Probe's parallel capability to collect ARXPS data, Avantage software provides the capability to extract the maximum information from ultra-thin films. Simple relative depth plots that determine layer ordering and calculators that determine layer thicknesses are easy to use. Our ARProcess plug-in uses advanced genetic algorithms to create composition profiles from an ultra-thin film stack. Simple relative depth plots that determine layer ordering, and calculators that determine layer thicknesses are easy to use. The ARProcess plug-in takes the data and uses advanced genetic algorithms to create composition profiles of an ultra-thin film stack.

Report

Turn XPS data into answers that colleagues and clients will easily understand

From simple copy-and-paste of data into spreadsheet programs, to full reporting of datasets into customized templates, Avantage software quickly disseminates information into reports, papers and presentations.





K-Alpha XPS System

High Performance X-ray Photoelectron Spectroscopy

ESCALAB 250Xi XPS Microprobe

Ultimate Performance and Versatility

Theta Probe XPS System

Powerful Thin Film Analysis

Avantage Features

The Avantage software is available on the Thermo Scientific K-Alpha XPS System, Thermo Scientific ESCALAB 250Xi XPS Microprobe and Thermo Scientific Theta Probe XPS System.

Control

- Full instrument control
  - Vacuum system
  - Sample transfer
- System calibration
  - Spectrometer
  - Sources
- Traceability
  - Instrument log files
  - Calibration logging

Acquire

- Flexible experiment design
- Automated processing with data acquisition
- Auto-analysis
- Full control of acquisition parameters
- Automatic scan optimization based on signal-to-noise
- Real-time data display
- Depth profile optimization

Understand

- Knowledge Viewer
- Automated SurveyID
- Automated Chemical State ID
- Avantage Indexer

Analyze

- Multiple background functions
  - Linear, Shirley, Tougaard
  - SMART™
- Quantification databases
  - Scofield, Wagner
  - Thermo optimized
- Peak fitting
  - Range of G/L ratio methods
  - Multi-level fitting
  - Complete control of fitting constraints
- Manual Peak ID
- Target factor analysis
- Non-linear least squares fitting
- Principal component analysis
- Phase analysis
- Spin-orbit subtract
- PCA reconstruct
- Energy deconvolution
- Differentiation and integration
- Multiple smooth functions
- Peak table profile
- Charge shift
- Relative depth plot
- Single overlayer calculator
- Multi-overlayer calculator
- Reconstruct depth profiles from ARXPS with the ARProcess plugin
- Spectrum arithmetic
- Etch rate calibration
- Interface width calculator
- Average spectrum from image
- Line/band scan
- Escape depth correction

Report

- Data compare functions
- Varied data display modes
  - 2D stack plots
  - 3D plots
  - Imaging displays
- Overlay XPS images onto optical images
- Export data directly to external programs via copy and paste
- Automated export functions to Microsoft® Office

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