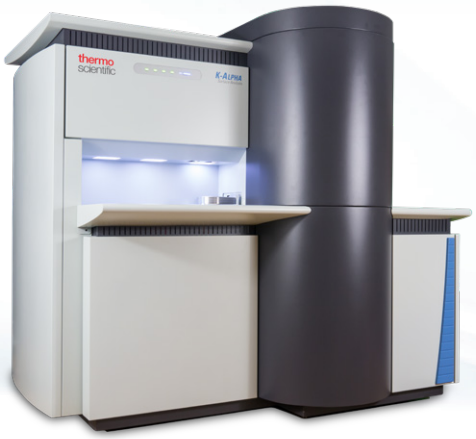
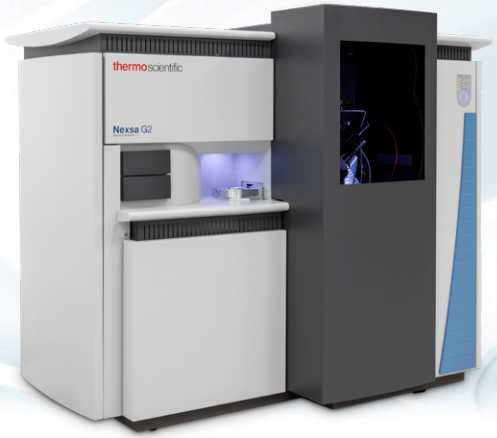
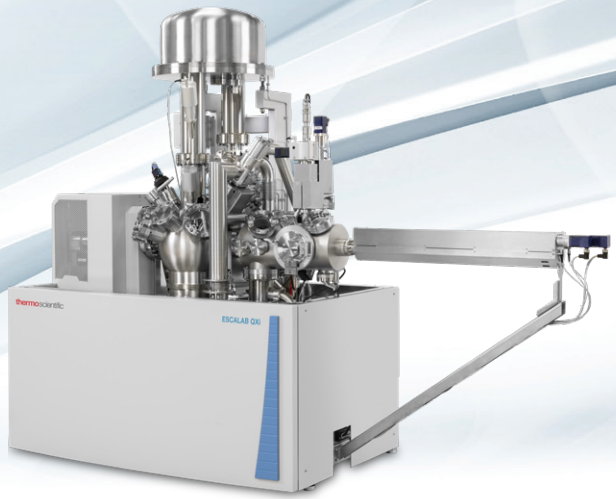
thermoscientific




# Instrumentation for surface analysis

## Surface chemistry and thin film characterization

ThermoFisher
SCIENTIFIC

# X-ray photoelectron spectroscopy

## Quantitative, chemical identification of the surface

X-ray Photoelectron Spectroscopy (XPS, also known as Electron Spectroscopy for Chemical Analysis – ESCA) is a highly surface-sensitive, quantitative, chemical analysis technique that can be used to solve a wide range of materials problems.

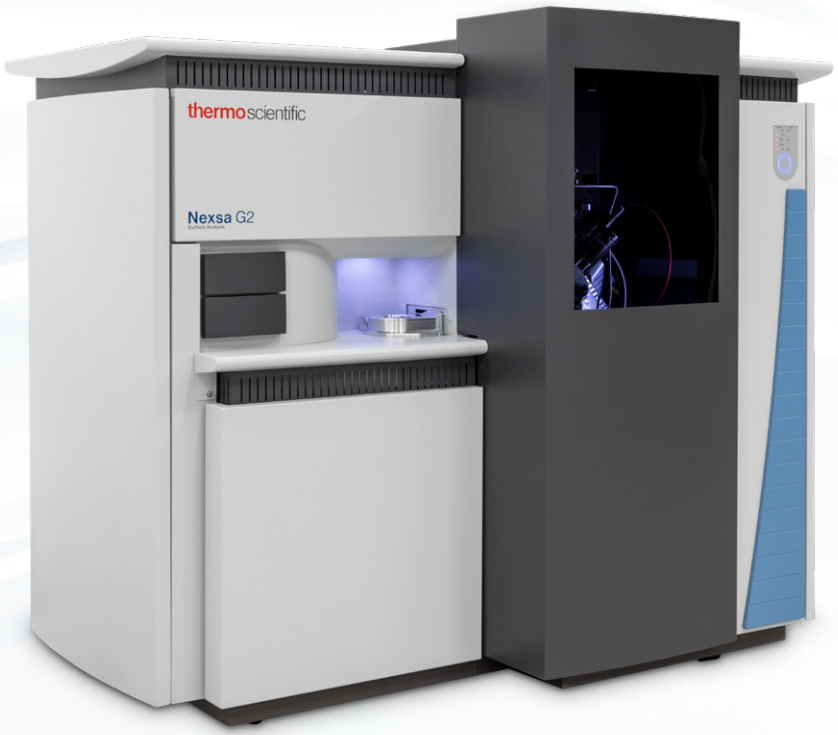
XPS is the measurement of photoelectrons ejected from the surface of a material which has been irradiated with X-rays. The kinetic energy of the emitted photoelectrons is measured, which is directly related to their binding energy within the parent atom; this is characteristic of the element and its chemical state.

Only electrons generated near the surface can escape without losing too much energy for detection; this means that XPS data is collected from the top few nanometers of the surface. It is this surface selectivity, coupled with quantitative chemical state identification, that makes XPS so valuable in a vast array of application areas.

# Nexsa G2 XPS System

## Unique correlative spectroscopy

The Thermo Scientific™ Nexsa™ G2 Surface Analysis System is a fully automated, multi-technique instrument. It features a new, micro-focus X-ray source, delivering both high sensitivity and high spatial resolution XPS. In addition, the system offers options for other surface analysis techniques: UPS, ISS and REELS. Uniquely, there is also the option to integrate a Raman spectrometer, aligned to the XPS analysis position, for true, correlative spectroscopy. With these features, the Nexsa G2 XPS System unlocks the potential for new insights in semiconductors, 2D materials, thin films, batteries, polymers and many other applications.




- High performance XPS
- Rapid SnapMap XPS imaging
- Depth profiling
- Optional multi-technique integration
  - Raman
  - ISS
  - UPS
  - REELS
- MAGCIS ion source for expanded depth profiling capabilities
- Large sample handling
- Avantage Software for instrument control, data processing, and reporting
- Optional transfer capabilities for air-sensitive samples
- Optional sample heating capability
- SEM data correlation Thermo Scientific Maps™ Software

### High-performance XPS with seamless multi-technique integration

From nanotechnology to polymer engineering, the questions posed by advanced materials development increasingly need a correlative approach to reach answers.

Learn more at **thermofisher.com/Nexsa**

# ESCALAB QXi XPS Microprobe

## Performance and versatility

The Thermo Scientific ESCALAB™ QXi XPS Microprobe is the latest development in our renowned ESCALAB product line. The ESCALAB QXi XP Microprobe is designed as an expandable, multi-technique platform with unparalleled flexibility and configurability. System control, data acquisition, processing and reporting are seamlessly integrated by the powerful Thermo Scientific Avantage Data System for surface analysis.


- High-resolution, quantitative XPS imaging for smallest feature analysis
- High-performance spectroscopy
- Ion source for depth profiling
- Optional automated sample exchange capability
- Flood source for insulator analysis
- Ion scattering spectroscopy (ISS) as standard
- Reflected electron energy loss spectroscopy (REELS) as standard
- Optional additional techniques:
  - Ultra-violet photoelectron spectroscopy (UPS)
  - Auger electron spectroscopy (AES)
  - Microanalysis (EDS)
  - Inverse photoemission spectroscopy (IPES)
- Optional MAGCIS dual mode ion source
- Full range of sample preparation options:
  - Sample heating and cooling
  - Fracture stage
  - Inert transfer

**Bringing together high-performance XPS with flexible sample preparation**

The ESCALAB product line has been at the forefront of surface analysis for decades, trusted by the experts to support their cutting edge research.

Learn more at **thermofisher.com/ESCALAB**

# K-Alpha XPS System

## Designed for productivity

The Thermo Scientific K-Alpha™ XPS System bridges the requirements for both research and routine XPS analysis. The high-performance system hardware makes the K-Alpha XPS System ideally suited to creating world-class data in a busy R&D environment. Intuitive workflows make it possible to put the K-Alpha XPS System into a multi-user, shared facility, allowing operators of all skill levels to add surface analysis to their materials analysis portfolio.

- High-performance, fully featured XPS system
- Unique sample viewing with capability to facilitate rapid feature identification
- Chemical state imaging
- Large sample handling
- Variable micro-focus X-ray source to match analysis area to feature
- Ion source for depth profiling
- Low energy flood source for insulator analysis
- Built-in standards for self-calibration


**Making XPS surface analysis routine**

Bringing XPS into multi-user facilities, materials research & development laboratories, or production support.

Learn more at **thermofisher.com/kalpha**

# MAGCIS Dual Beam Ion Source

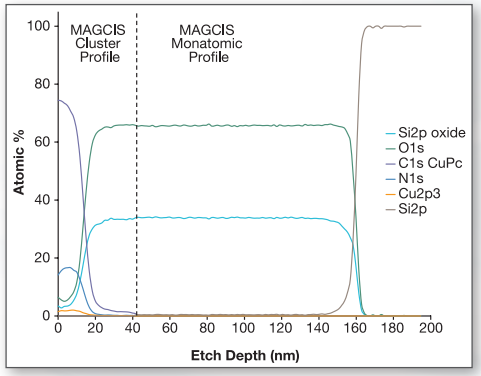
## Monatomic and gas cluster ion source option for Thermo Scientific XPS spectrometers

Analysis and surface cleaning of both soft and hard materials on the same XPS instrument. Switching between gas cluster sputtering and monatomic sputtering is handled completely by Avantage Data System, and can be done in a matter of seconds.

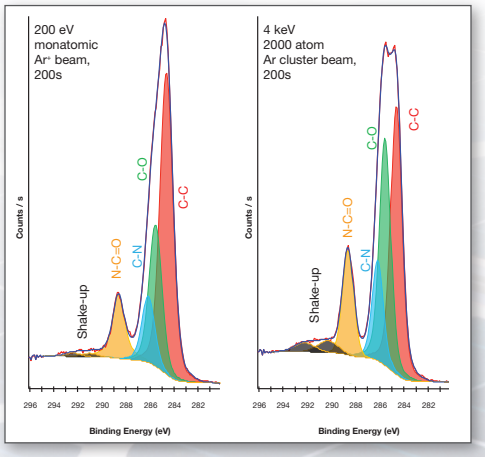
Gas cluster ion depth profiling opens up a variety of applications: investigate oil-resistant coatings on touch screens, measure plasma deposited coatings for biomedical devices, or characterize OLEDs and solar cells.

Used for decades, monatomic ion sources, typically using $Ar^+$ as a projectile, clean surfaces and enable analysts to investigate changes in chemistry relative to depth. However, the technique has limitations as it can induce damage on certain surfaces, changing the chemistry of the material.

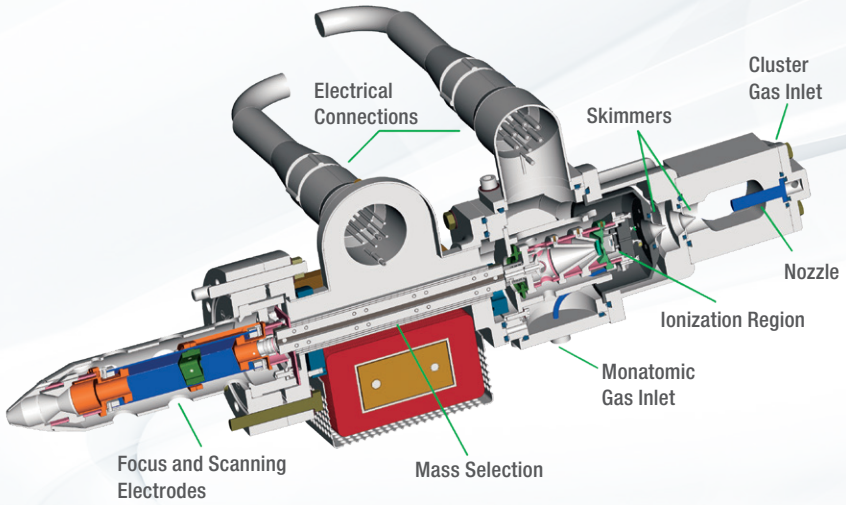
With the introduction of the MAGCIS Dual Beam Ion Source, you can operate as both a monatomic ion source and a cluster ion source in a single experiment and overcome these limitations. The MAGCIS Dual Beam Ion Source opens analysis of new, formerly inaccessible, classes of materials.




▲ **Depth profile of an organic FET showing both monatomic and gas cluster ion etching.**




▶ **Comparison spectra of a polyimide sample showing damage (left) from Ar+ beam, while surface chemistry is retained with the Ar cluster beam (right).**



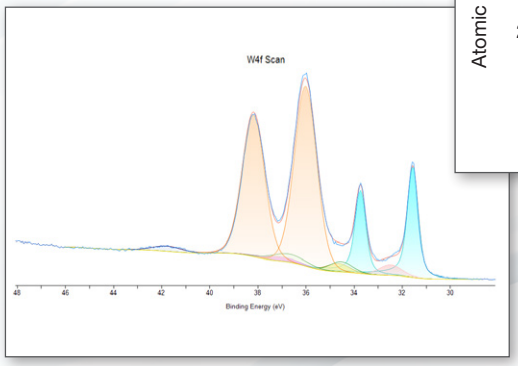

- Patented* dual mode design
- Variable cluster size (up to 2,000 atoms)
- Cluster energy/atom from 1 eV upwards
- Monatomic $Ar^+$ mode (0.5–4 keV)
- Fast, automated mode switching
- Full control through Avantage
- Automated setup and alignment

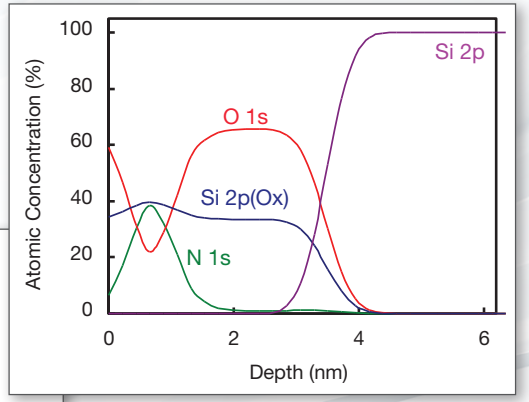
*** GB Patent 10171713.4**
**US Patent 2013/0180844 A1**

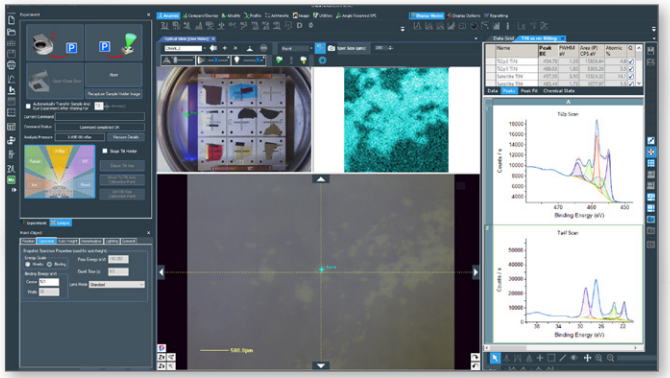
# Avantage Data System

## 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 Data System 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 Data System to obtain the maximum information from their samples.



- Instrument control for all Thermo Scientific surface analysis systems:
  - K-Alpha XPS System
  - ESCALAB QXi XPS Microprobe
  - Nexsa G2 XPS System
- Fully flexible experiment design, including multi-technique integration
- Import/export of analysis positions for SEM correlation
- Automated data acquisition including data processing functions and reporting
- Thermo Scientific Knowledge View™, references and intelligent algorithms for data interpretation
- Advanced data reduction tools
- Easy export to reporting software

# About Thermo Fisher Scientific

We are the world leader in serving science. Our mission is to enable our customers to make the world healthier, cleaner and safer.

**Step ahead. Step beyond.** Duration 1.33

Our innovative solutions for 3D electron microscopy, spectroscopy, and microanalysis help materials science researchers advance their sample characterization to gain deeper insight into materials using the latest advances in analytical instruments. Our multiscale, multimodal solutions provide the additive manufacturing industry with imaging and characterization of powders and parts at nano- to atomic-level resolution.

Our TEMs, DualBeam™ FIB/SEMs, surface analysis systems, and comprehensive portfolio of SEMs, combined with software suites, take customers from questions to usable data by combining high-resolution imaging with physical, chemical, elemental, mechanical, and electrical analysis across scales and modes—through the broadest sample types.

## Financial and Leasing Services

At Thermo Fisher Scientific, we will not let budgetary constraints stand between you and your next great discovery.

We are your one-stop partner for the best laboratory products and analytical technologies available, plus the unique financing options you need to accelerate success in science or industry.

Cost-effective financing designed for each individual customer is key to any successful capital equipment solution.

We understand not just your advanced technology and application requirements, but the business challenges you face when financing your critical equipment assets. For decades, we have worked closely with businesses, hospitals, universities, and municipalities to provide flexible financing terms to support their successful operations.

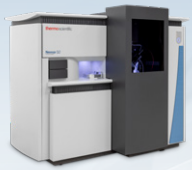
If you are looking for off–balance sheet financing, accelerated ROI, technology protection, or cash flow management, our innovative financing options can help meet your company's budgetary needs and bottom-line goals.

**Explore equipment leasing and financing options**

We also offer instrument maintenance and training services.

thermoscientific

# The full spectrum of surface analysis



| | | K-Alpha | ESCALAB QXi | Nexsa G2 |
|---|---|---|---|---|
| **XPS capabilities** | Large area XPS | ● | ● | ● |
| | Small area XPS | ● | ● | ● |
| | XPS imaging | ● | ● | ● |
| | SnapMap | ● | | ● |
| | Charge compensation system for insulator analysis | ● | ● | ● |
| | Ion Source for depth profiling | ● | ● | ● |
| | Angle dependent XPS | ○ | ● | ○ |
| | Automated sample transfer | ● | ○ | ● |
| **Selected analytical options** | Raman spectroscopy | | | ○ |
| | MAGCIS Dual Beam Ion Source | | ○ | ○ |
| | Reflected electron energy loss spectroscopy (REELS) | | ● | ○ |
| | Low energy ion scattering spectroscopy (ISS/LEIS) | | ● | ○ |
| | UV photoelectron spectroscopy (UPS) | | ○ | ○ |
| | Auger electron spectroscopy and EDS | | ○ | |
| | Sample preparation options | | ○ | ○ |
| | Inert sample transfer | ○ | ○ | ○ |

Included ● Optional ○

Use our Product Selector Tool to quickly find your ideal instrument: thermofisher.com/xps-product-selector

Find out more at **thermofisher.com/xps**

ThermoFisher SCIENTIFIC

**For research use only. Not for use in diagnostic procedures. For current certifications, visit thermofisher.com/certifications**
© 2021 Thermo Fisher Scientific Inc. All rights reserved. All trademarks are the property of Thermo Fisher Scientific and its subsidiaries unless otherwise specified. BR53097-EM-11-2021