AZtecFeature

Automated particle analysis in the SEM

Right Results in Real Time...

OXFORD INSTRUMENTS

The Business of Science®

AZtecFeature

Automated particle analysis in the SEM

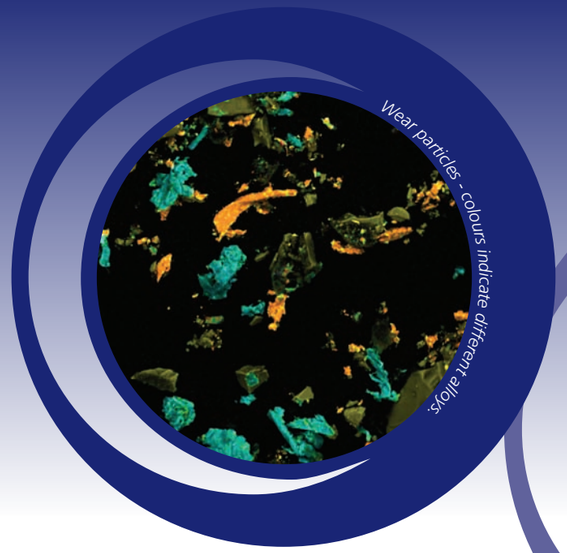
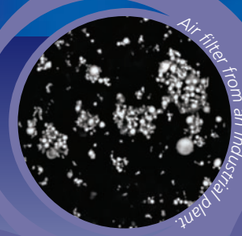
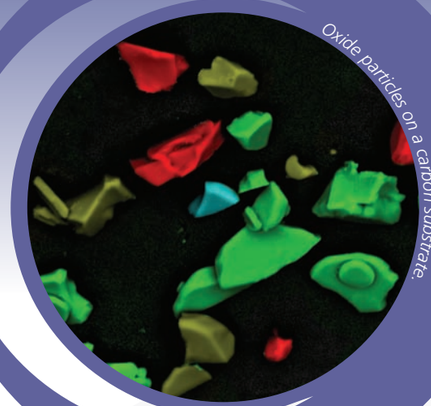


Image courtesy of INDAM Laboratori s.r.l.





AZtecFeature combines the raw speed and sensitivity of the **X-Max^N** Silicon Drift Detector with the superior analytical performance and ease of use of the **AZtec®** EDS analysis suite to create the most advanced automated particle analysis platform on the market.

Using a guided workflow and intelligent **AZtec**Feature algorithms, even occasional users will be amazed how quick and easy it is to detect and characterise thousands of particles that may be present over large sample areas. Reports on particle position, morphology and chemical composition are automatically produced moments later.

For the fastest throughput at unparalleled sensitivity, up to four **X-Max^N** detectors can be combined to make a system with an astounding 600 mm^2 working area. **AZtec**Feature then processes the avalanche of raw data in real-time using Tru-Q® quantitative analysis algorithms to provide the right result instantly.

The innovative particle characterisation system specifically optimised for high-speed throughput.

AZtecFeature

At a glance...

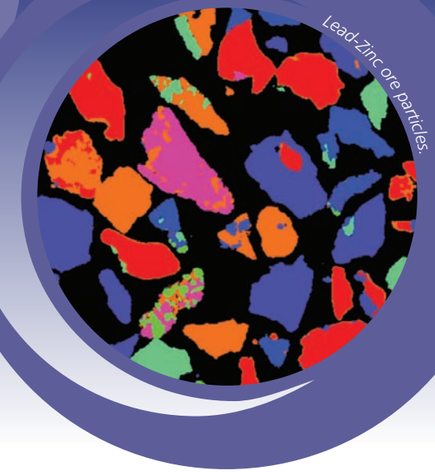
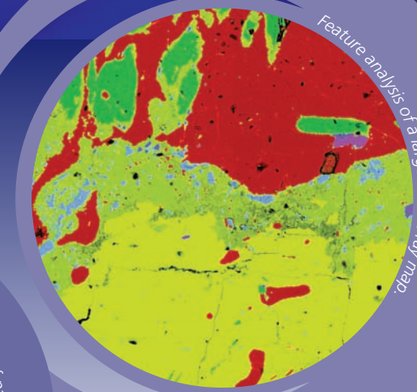
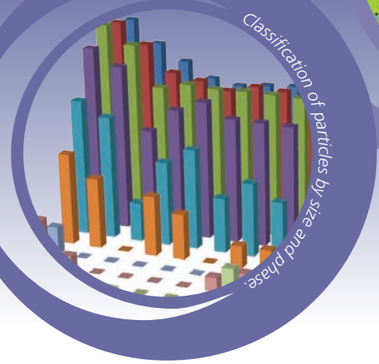


Image courtesy of Juliane Hennig, RHUL.





Fast and Powerful

- Unleashes the potential of the latest generation of large area **X-Max^N** SDDs - delivering sensitivity when count rates are low and high capacity when count rates are high.
  - Choice of detectors to suit budget and needs
  - Up to four detectors can be combined to deliver maximum throughout and sensitivity and eliminate shadowing of particles on rough samples.
- **AZtec** has 64-bit performance and is truly multi-tasking
  - Up to 200,000 particles characterised on one sample
  - Real-time detection, morphology and chemistry analysis
  - On-line or post acquisition elemental and phase analysis of particles
  - Parallel analysis and reporting during acquisition

Accurate

- **AZtec**Feature incorporates Tru-Q technology to provide unparalleled elemental identification and quantitative analysis without requiring user intervention, making it the ideal system for unattended data collection
- Unique pulse pile-up correction ensures accurate quantitative analysis even at the highest count rates

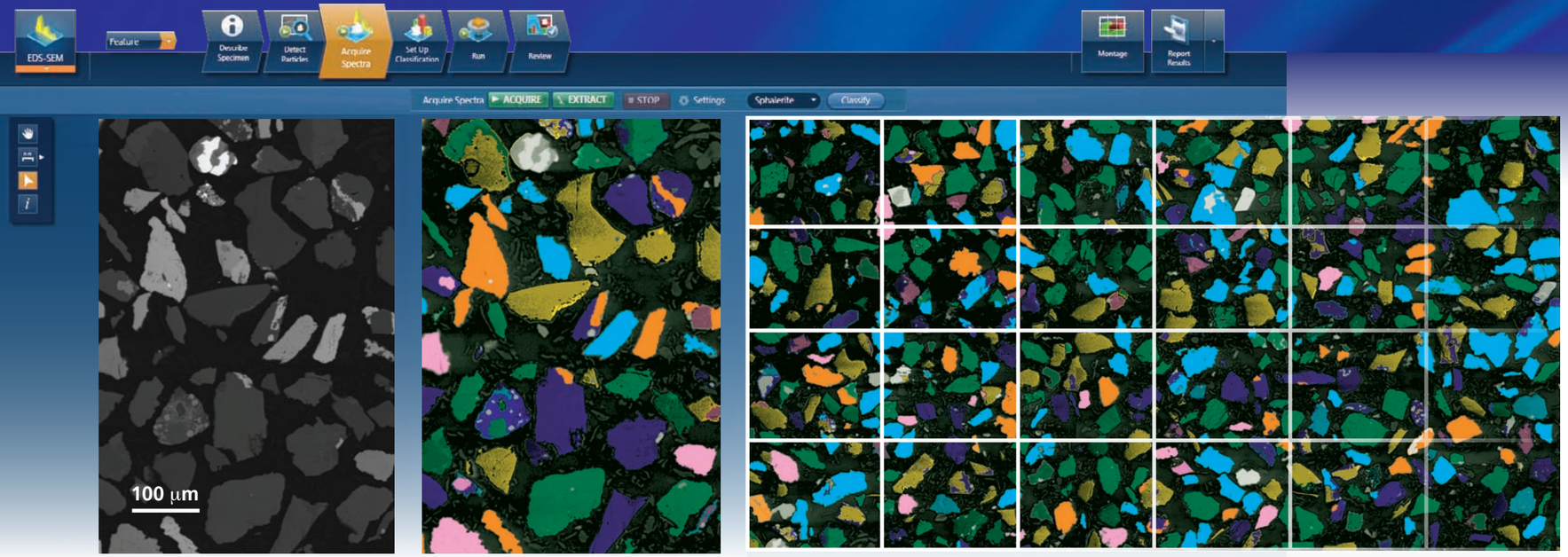
Easy to Use

- Even for new samples, results are obtained in seconds - there's no need for laborious setup procedures
- Morphological and chemical measurements are acquired automatically and are easily incorporated into particle classification schemes
- The complete system setup can be stored as a recipe and recalled at a later date

PRODUCTIVITY

Particle analysis made easy

As automated as possible...as flexible as needed



Analysis of particulated lead/zinc ore.

Data in seconds...

Automated feature and particle analysis has never been so easy! Basic particle sizing is available immediately: click on one particle and others in a similar grey level will be automatically detected and their morphology displayed.

- Real-time calculation of morphological parameters
- Particle size, shape, aspect ratio... are shown instantly
- Manually fine-tune particle detection by adjusting thresholds and adding image filters for noise reduction, particle separation etc.

...simply add chemistry

As **AZtec**Feature is fully integrated with the rest of the **AZtec** Suite, adding chemical data could not be easier...

- Acquire an EDS spectrum for each particle automatically
- Use existing settings in the **AZtec** user profile for spectrum processing
- Generate the right result using Tru-Q algorithms
- Start building a classification scheme at the click of a button

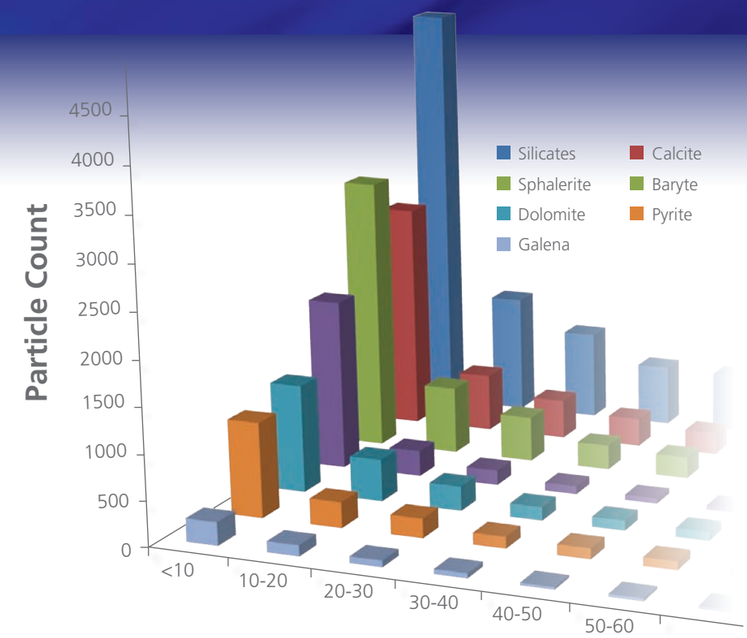
A simple step from single field to large area analysis

Going from single field analysis to acquiring data over a large area of a specimen or even several specimens is easy:

- A wizard guides users through the setting up of areas and samples
  - Areas can be stored and recalled for later use
- For each sample, up to 200,000 particles over thousands of fields of view can be analysed automatically
- The system fully automates the stage movement, image acquisition and EDS acquisition and stitches the acquired data together into a single large area. Individual fields are automatically shown in a montaged view during acquisition
- See the 'big picture' and zoom into details during acquisition
- Relocate to any field and acquire data for further analysis
- Automatic system pause when a blown filament is detected*

** Microscope dependent*

Turn data into knowledge...and share results with others



Reporting

As soon as data from a particle is acquired, it is added to a customisable list displaying morphological and compositional measurements and particle classifications.

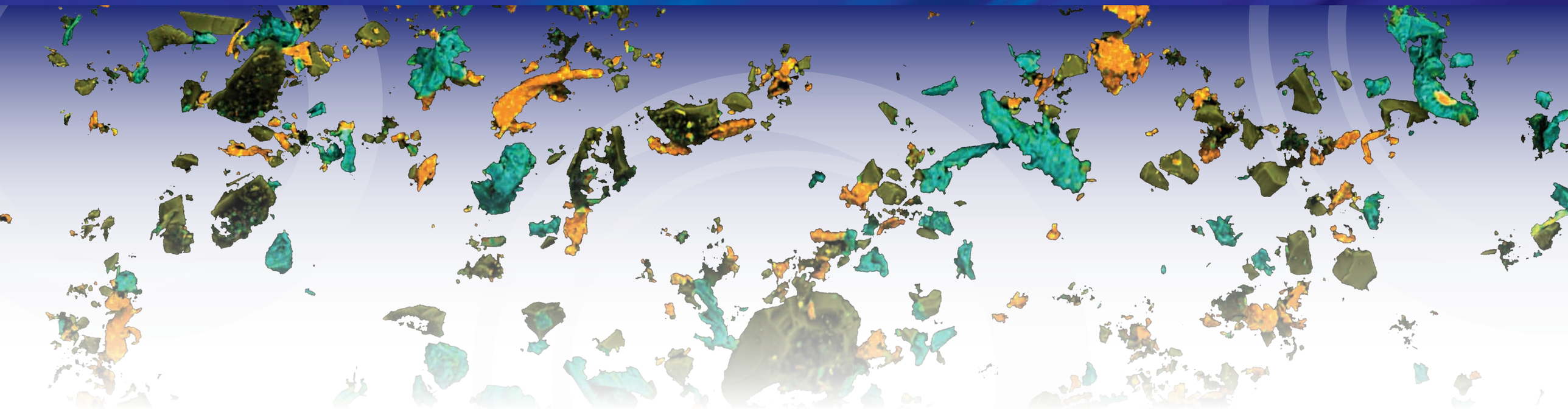
- Users can interact with and interrogate the tabulated results while data acquisition is still in progress
- The data can be visualised in the form of histograms and summary reports can be generated directly into Microsoft® Word
- For further, more detailed analysis and plotting options, comprehensive data export into Microsoft Excel is available

Reliable results - achieved faster than ever

Applications

Providing the data to take informed decisions

Demand more from your analysis system



Informed decisions based on morphology and chemistry

Unlike light-optical methods, **AZtec**Feature classifies particles and features not only by size and shape but also by their chemical composition, including any combination of these parameters.

The extra dimension provided by compositional analysis creates certainty as to the origin and impact of identified particles on materials properties or an industrial process. It opens up applications in R&D and industrial process control such as:

- **Technical cleanliness –** identify the source contaminants in precision manufacturing processes in the electronics, semiconductor and automotive industries
- **Engine wear analysis –** monitor combustion engine health by analysing particles found in engine oil filters
- **Steel cleanliness –** analyse the nature and origin of non-metallic inclusions in metals and steels
- **Forensic analysis –** detect and analyse trace evidence material in crime science and industrial forensics
- **Geology and mineralogy –** identify and measure phase compositions and textures in geological samples
- **Air filter analysis –** monitor air quality and pollution by analysing particles on air filters
- **Asbestos -** identify fibres in a sample by morphological analysis and confirm the type of asbestos present by chemistry

Rare particle detection

AZtecFeature is ideally suited to rapidly find rare features or particles of interest, solving so-called 'needle in a haystack' problems.

By processing the electron image, candidate features can be identified rapidly and their chemistry confirmed by EDS. This technique is widely used in crime forensics to identify gunshot residue and for identifying precious metals in ore samples. It can cut the analysis time from hours to minutes and free up the operator's time.

Big Data - processing large area maps

AZtec offers the automated acquisition of large area X-ray maps which are used to reveal nanoscale features distributed over large areas. **AZtec**Feature is used to extract X-ray data from large area maps comprising tens of gigabytes of data. By intelligently combining the information from electron images and X-ray mapping data, **AZtec**Feature is an effective data mining tool to analyse large sets of analytical data.

- Search large area mapping data for particular phases or inclusions
- Perform morphological measurements and classify the features found in these datasets
- Quantify grain sizes and shapes for compositionally inhomogeneous phases
- Work on previously acquired mapping data

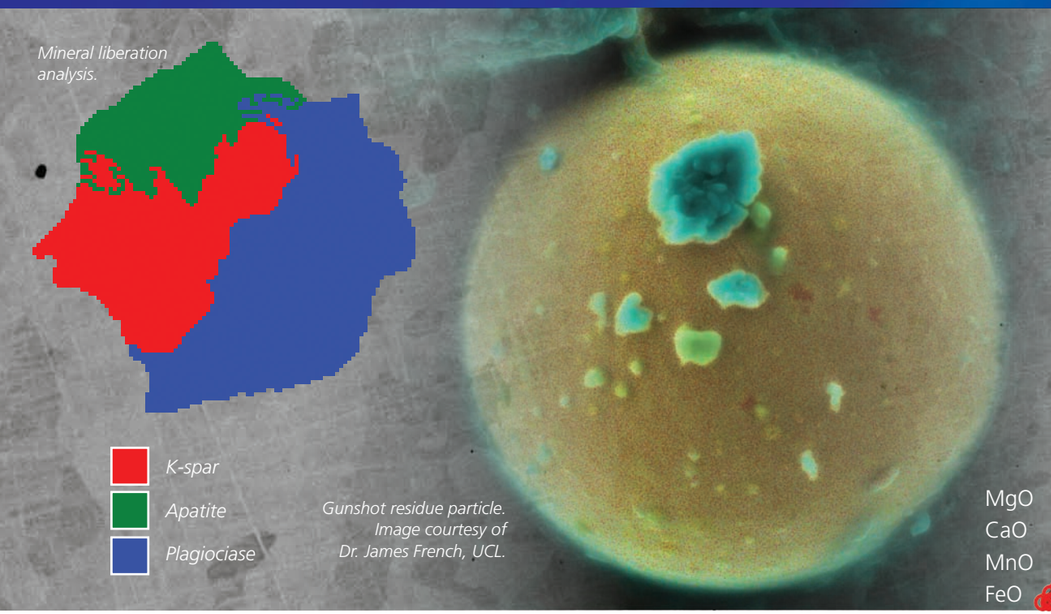
POWERFUL

Application specific modules

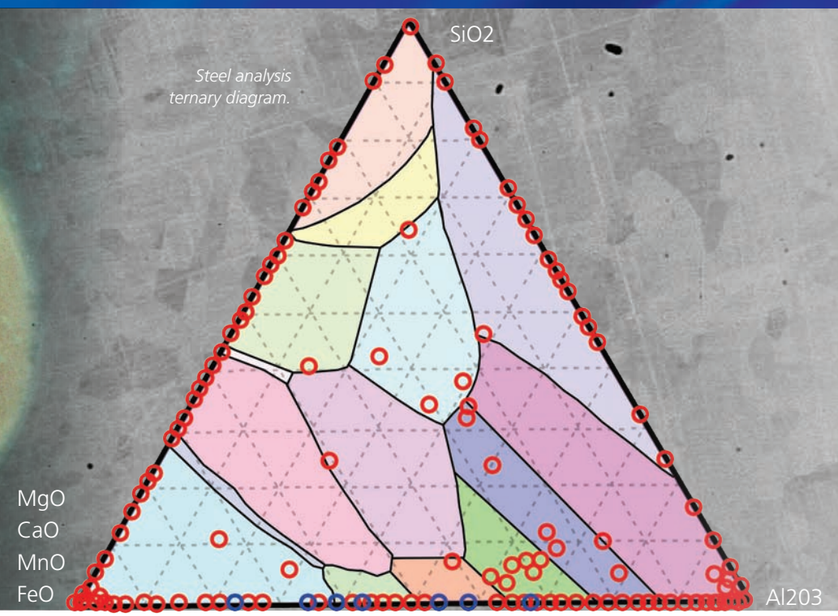
Process specific data to standards and norms

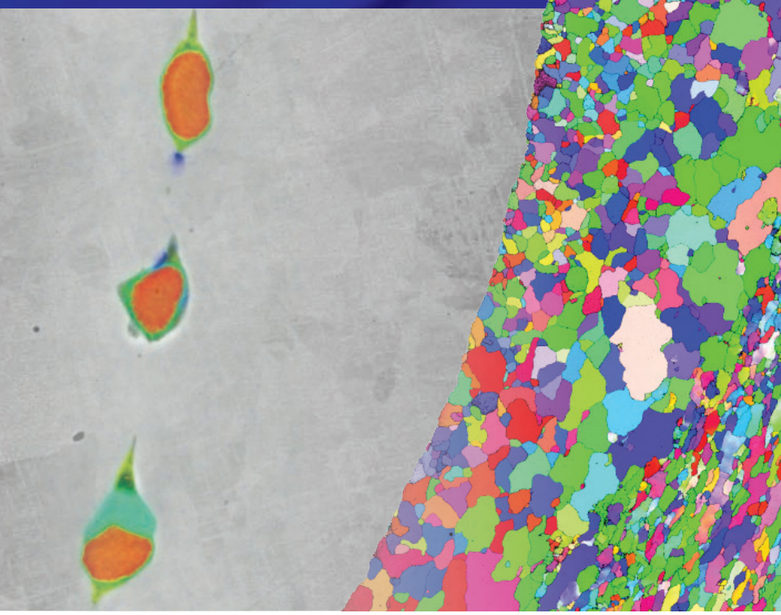
Beyond particle analysis

Exploit the full range of AZtec functionality



Gunshot residue particle. Image courtesy of Dr. James French, UCL.





X-ray and EBSD analysis of steel and its inclusions.

Automated mineralogy*

The most advanced and cost-effective automated mineralogy system on the market.

- Automatically analyse grain mounts and polished rock sections
- Calculate mineral liberation, modal mineralogy and phase associations
- Directly report phase compositions and compare to assay results
- Use dedicated setups for a range of different ore types

Gunshot residue analysis*

The GSR module adds dedicated setups for crime forensics and gunshot residue analysis. It enables particle classification and reporting according to ASTM 1588-10$^{\varepsilon 1}$.

- Classification for all ammunition types
- Reliable identification of gunshot residue particles
- Standard samples for system calibration and optimum repeatability

Metals quality analysis

Analyse inclusions in steels, tyre cords and powder metallurgy...

- Determination of steel cleanliness according to a range of international standards
- Identification and classification of complex inclusions, stringers and clusters
- Comprehensive, automated report generation including statistical data on inclusion types, ternary phase diagrams and plots etc.

** Modules available in **INCA**Feature and a subsequent release of **AZtec**Feature.*

Advanced characterisation

The integration of **AZtec**Feature with the other modules in the **AZtec** nanoanalysis suite enables seamless transitions between different techniques and sensors.

For example, if a particle of specific interest is identified during an automated run, it can be relocated and an X-ray or EBSD map acquired in seconds. **AZtec's** advanced TruMap and TruPhase functionality correct for overlaps and background variations in EDS data and identify phases unambiguously by combining EBSD and EDS data.

Integration enables:

- Automated pre-screening of samples with **AZtec**Feature
- Subsequent re-analysis of specific features using alternative techniques
- Combination of feature analysis with
  - X-ray mapping
    - TruMap - removes background and peak overlaps in real-time
  - Detailed spectrum analysis with interactive overlaps and element profiles
  - Film thickness (**LayerProbe**®)
  - EBSD analysis
    - TruPhase - combines X-ray and EBSD for unambiguous phase identification

See more, do more, learn more.

Silicon Drift Detector hardware

Powerful, sensitive, fast

What took hours with an LN_2 system now takes minutes. It's time to upgrade!

A range of detectors

Oxford Instruments' **X-Max^N** Silicon Drift Detector comes in a range of sizes to suit budget and application - from 20 mm^2 for basic microanalysis up to an astounding 150 mm^2 for advanced nanoanalysis. The latter is the largest SDD in the market and delivers more than double the speed of any other detector.

For applications that do not demand the full **X-Max^N** performance, **x-act** is available. It is a fully quantitative 10 mm^2 SDD with excellent performance at low and high count rates.

- A range of silicon drift detector sizes
  - From 150 mm^2 to 20 mm^2
  - The same geometry inside the SEM means count rate increases in proportion to sensor size

All **X-Max^N** detectors provide:

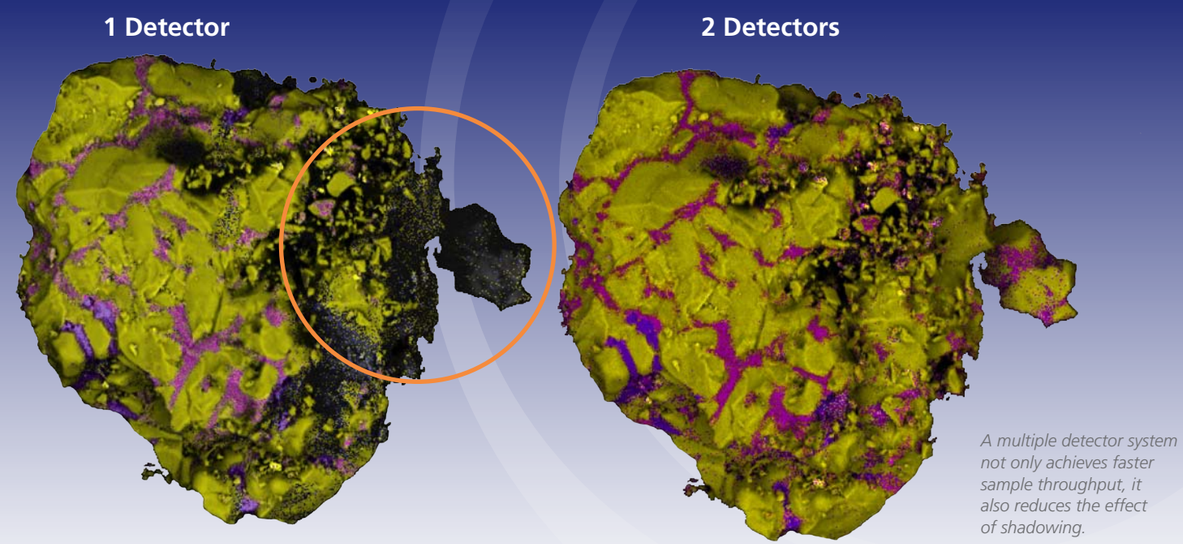
- The best low energy performance – all detectors clearly resolve Be
- The same excellent resolution, guaranteed on your microscope
- The same physical geometry, so existing systems can be easily upgraded

Using a larger sensor means:

- Usable count rates at lower currents
- Maximising imaging performance and accuracy enabling the detection of sub-micron particles and nanoparticles
- Significantly higher count rates at the same beam current
- Shorter acquisition times and better statistical confidence
- Practical analysis with small beam diameters, maximising spatial resolution

Multiple detector systems

For the ultimate throughput and sensitivity



A multiple detector system not only achieves faster sample throughput, it also reduces the effect of shadowing.

Multiple detector systems

When used in automated process control adding one or more extra detectors can significantly enhance the sample throughput.

For challenging applications, with very small particles or particles on beam sensitive substrates such as some polycarbonate filters, using high beam currents is not an option. In such cases multiple detectors can provide an effective solution to enhance the collection efficiency so that particle detection can progress rapidly. For samples where particle size varies significantly, shadowing of smaller particles by larger particles can be a significant issue when only one detector is used. Having at least two detectors mounted on opposing ports can overcome these shadowing effects.

- Up to four **X-Max^N** can run in parallel on one microscope to create a system with a total active area of 600 mm^2

Multiple detectors enable the analysis of:

- Nanoscale particles at low kV where the highest solid angle is required
- Particles on beam sensitive substrates (e.g. filters, resins etc)
- Samples of particles with varying size where shadowing of smaller particles is an issue

Unmatched in breadth and scalability, **AZtec**Feature is a must for anyone serious about particle analysis...

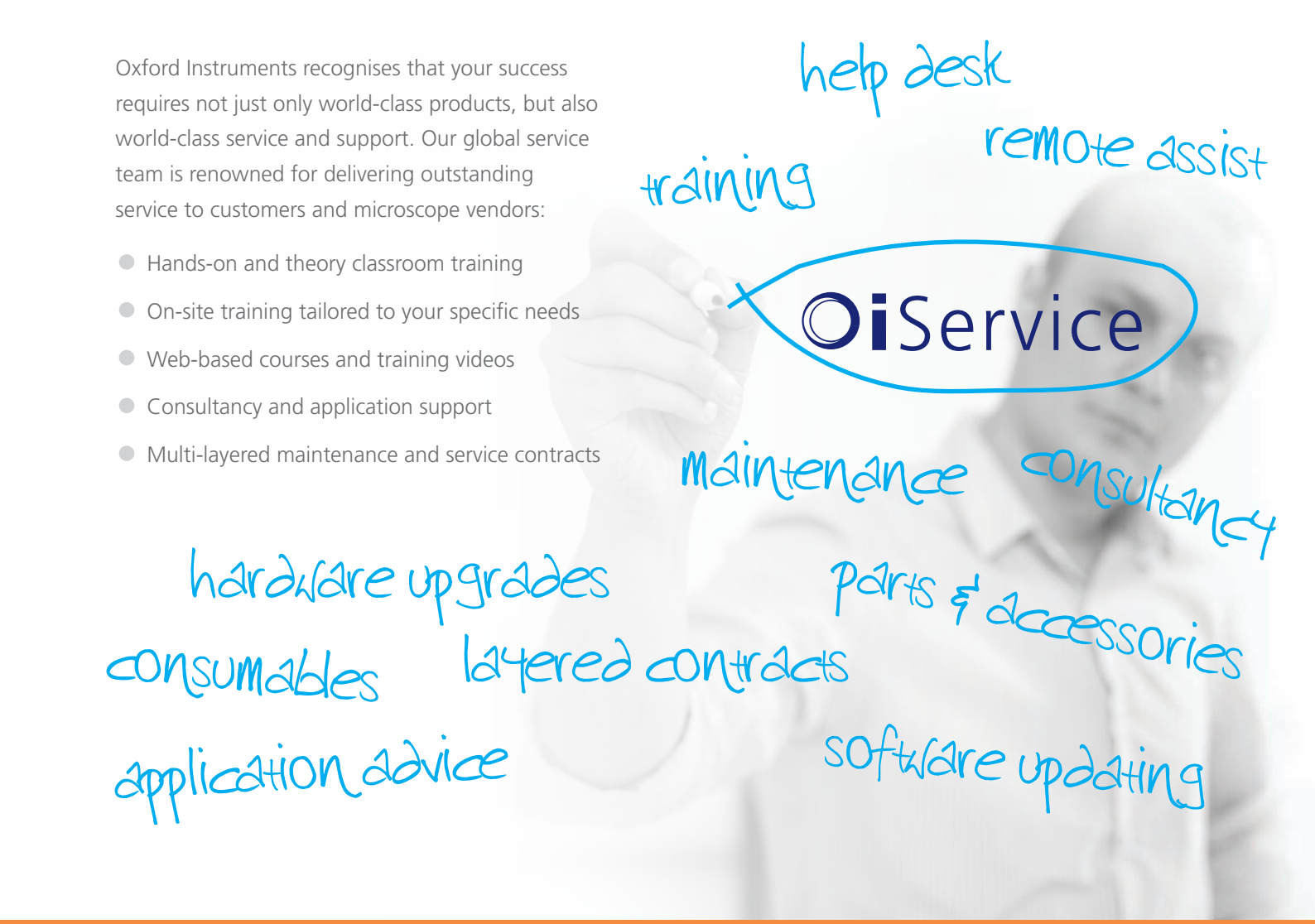
OISERVICE

Global Customer Support

Accredited, experienced, responsive, dedicated

Oxford Instruments recognises that your success requires not just only world-class products, but also world-class service and support. Our global service team is renowned for delivering outstanding service to customers and microscope vendors:

- Hands-on and theory classroom training
- On-site training tailored to your specific needs
- Web-based courses and training videos
- Consultancy and application support
- Multi-layered maintenance and service contracts



visit **www.oxford-instruments.com/AZtecFeature**

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