

MATERIALS CHARACTERIZATION SOLUTIONS

**SEAMLESS
INTEGRATION**

of

EDS, EBSD, and WDS

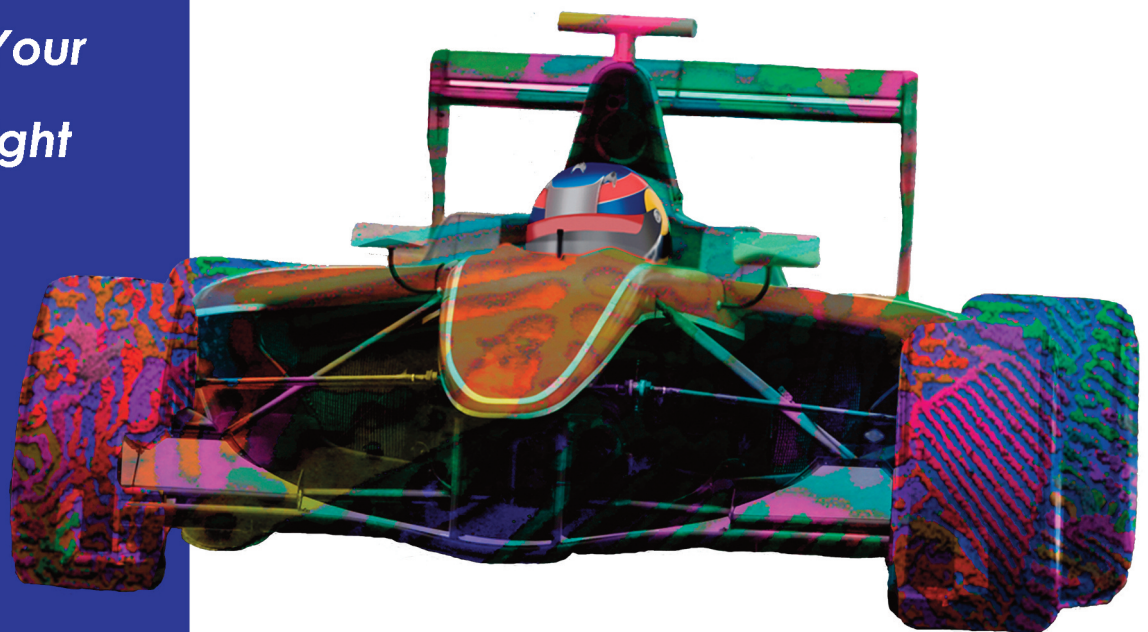
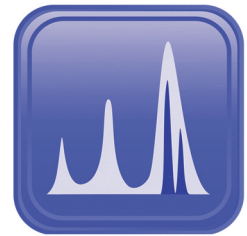
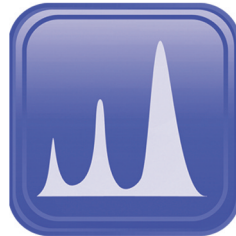
Provides Complete

Materials

Characterization

To Drive Your

Next Insight



Simultaneous EDS, EBSD and WDS



Complete Materials Characterization Systems

To fully understand a material, whether it is naturally occurring or man-made, the scientist often needs to determine the relationships between its physical properties, chemical composition, crystallographic structure and morphology. The seamless integration of energy dispersive spectroscopy (EDS), electron backscatter diffraction (EBSD), and wavelength dispersive spectrometry (WDS) on the electron microscope allows a direct correlation between the chemical and microstructural aspects of materials.

- EDS provides chemical analysis from a simple qualitative study to a complex quantitative analysis. Multiple X-ray mapping options and particle morphology are also available to the scientist.
- EBSD supplies crystallographic orientation data necessary to understand the microstructure-property relationships for research and development, process development, quality control, and failure analysis.
- WDS is a complementary technique for EDS X-ray analysis providing superior energy resolution and higher sensitivity for more accurate qualitative analysis and improved quantitative measurements.

Simultaneous EDS, EBSD and WDS

Why Integrate Technologies?

Optimal performance is achieved through concurrent design of the analytical tools within the scanning electron microscope (SEM). Seamless integration is attained through comprehensive data collection and sharing between the different techniques. Collaboration between the SEM manufacturer and EDAX has provided integrated designs that enable the detectors, electronics, and software to operate in an uncompromised environment. Applications for all chemical and structural analysis needs are satisfied with EDAX's tools, both integrated and stand alone, to meet the most demanding needs of today's scientists and engineers.

All three techniques operate within EDAX's TEAM™ Analysis Software with Smart Features, blending powerful elemental analysis routines with an intuitive and easy to use interface that ensures ideal data collection, faster analysis and flexible reporting for users of all levels.

TEAM™ Pegasus

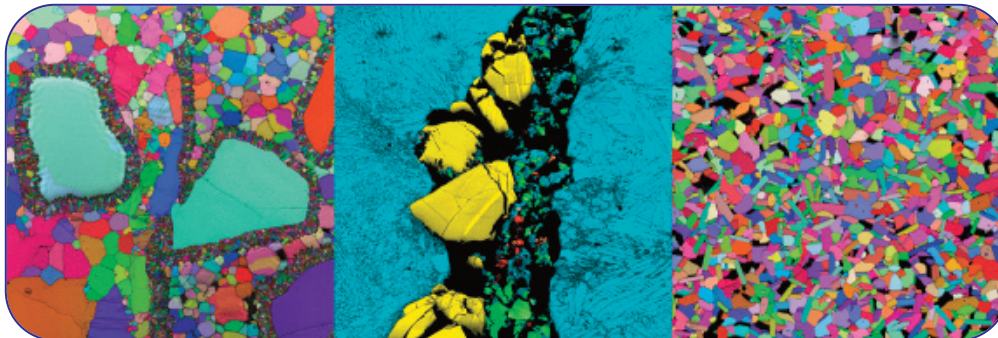
Materials characterization incorporating structural analysis and chemical data from EDAX's technology leading EDS and EBSD systems. Accurate phase and multi-phase analysis is achieved by combining simultaneously collected data sets to understand problems that the individual techniques cannot solve alone.

TEAM™ Neptune

Complete chemical analysis combining the power and flexibility of EDS with the resolution, precision, and detection limits of WDS to extend X-ray microanalysis capabilities. The selectivity of WDS complements the simultaneous data acquisition of EDS to improve both qualitative and quantitative analysis.

TEAM™ Trident

The ultimate materials characterization tool integrating the latest technologies of EDS, EBSD and WDS to deliver solutions which were previously unattainable. This optimized configuration offers the uncompromised performance of each individual technique and also provides the ability to combine them for the ultimate materials insight.



The Ultimate Automated Microanalysis System

Why EDS?

Energy Dispersive X-ray Spectroscopy (EDS) is an electron microscope based analytical technique used predominantly for the elemental analysis or chemical characterization of a specimen. EDS provides materials characterization solutions for many X-ray microanalysis applications, from straightforward qualitative analysis and accurate quantitative analysis, to fast X-ray mapping and automated particle classification. EDAX's powerful TEAM™ EDS Analysis System provides analytical solutions to the most complex materials characterization problems.

TEAM™ EDS Analysis System

Provides all the tools needed from simple qualitative analysis to advanced quantitative calculations.

Features Include:

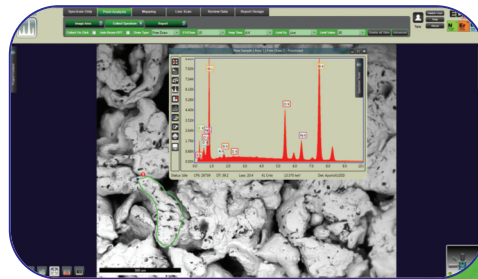
- Smart Features ensure consistent data collection, analysis, and reporting, regardless of the experience level of the operator.
- EXpert ID uses analytical intelligence to separate overlaps and uncover minor peaks.
- Unique Halographic Peak Deconvolution (HPD) for visual peak confirmation.
- Superior standardless quantification algorithm and full standards quantification.

Mapping and Linescans

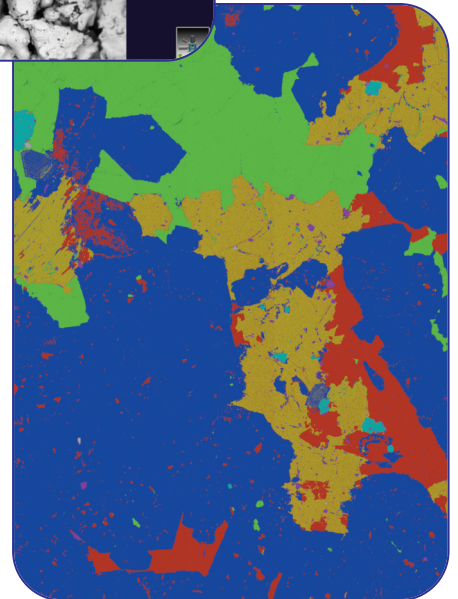
Extensive mapping and linescan capabilities from simple X-ray maps to automated phase analysis.

Features Include:

- Live phase mapping with a wide range of resolutions and data types.
- Extended data processing capabilities allow the user to generate maps and linescans including phase, quant, net, ROI, and gross intensities from the collected data sets.
- Collect and montage data from multiple fields.
- Advanced mapping features such as Phase Analysis and CPS Mapping.



Intuitive and easy to use TEAM™ interface.



Overlay X-ray map showing the mineral distribution of a granite sample.

Reporting

Organize and communicate results efficiently with TEAM™ Reporting.

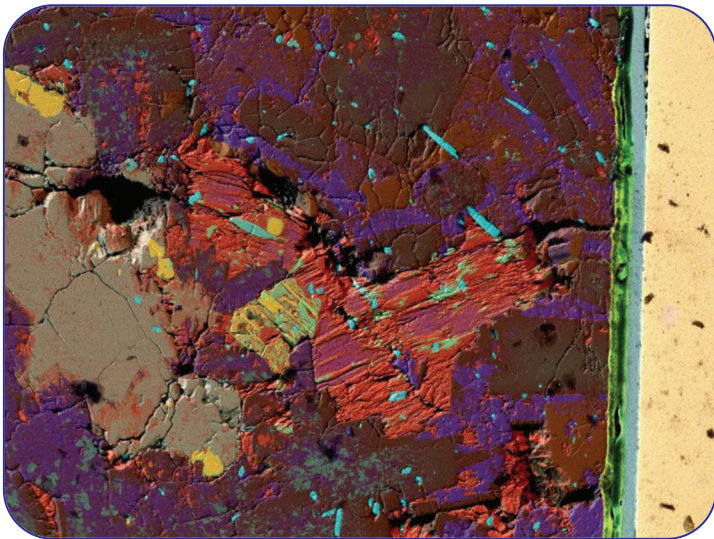
Features Include:

- Choice of standard Microsoft Office suite documents and Adobe PDF.
- Quick Reports which allow the user to tailor report content and layout to specific analytical needs.
- Customizable analysis templates for advanced and interactive EDS reports.

The Ultimate Automated Microanalysis System

EDS Hardware

EDAX EDS systems provide the analytical software and technologically advanced hardware required for cutting-edge materials characterization. The digital pulse processor electronics provide a powerful combination of digital and analog electronics that work in combination with a scan generator to provide a platform for ultra fast X-ray mapping. The EDS detector portfolio includes a full range of silicon drift detectors (SDD). The SDDs utilize the latest SDD chip technology for optimum performance.



High resolution X-ray map of complex features can now be collected in a fraction of the time taken using earlier technology.

Element Series SDD

Element SDDs deliver powerful analytical capability in a compact package, maximizing performance and flexibility to guarantee fast results and ease of use in an industrial environment.

Features Include:

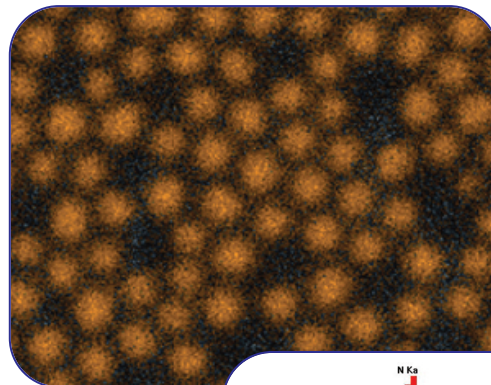
- 133 eV or better resolution.
- Throughput >100,000 cps.
- Silicon Nitride windows.
- Optimized for low energy transmission for better light element detection.
- Easy to use software with touchscreen capability.
- Fast, efficient results for industrial needs.

Octane Series SDD

Utilizing the latest generation SDD technology, Octane SDDs deliver high quality, high resolution EDS data at previously unachievable speeds.

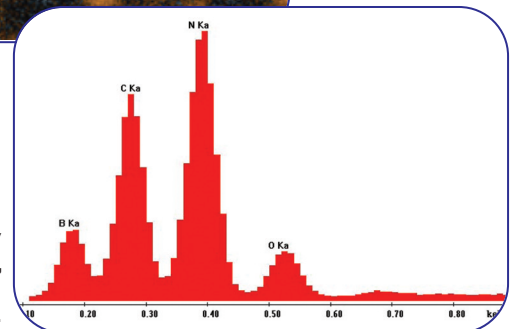
Features Include:

- Resolution of 129 eV standard on all models.
- Resolution available down to 121 eV.
- Excellent low energy performance.
- Resolution stability >90% up to 200 kcps.
- Count rates up to 1.6 Mcps with throughput rates of 800 kcps.
- SDD modules up to 100 mm².



Low kV microanalysis: Nickel nanopillars on Indium at 3 kV.

Light element X-ray spectrum of B, C, N, O collected using an Octane Pro SDD.



The Definitive Structural Analysis Solution

Why EBSD?

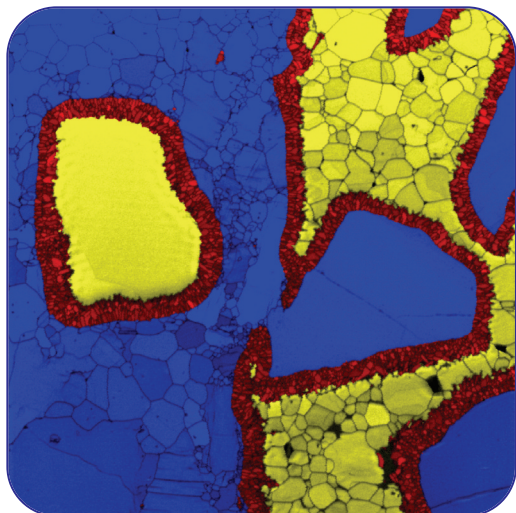
The TEAM™ EBSD Analysis system combines the ease of use of the TEAM™ software platform with the analytical power of Orientation Imaging Microscopy (OIM™) to provide state of the art crystal structure characterization to all users. OIM™ is a technique based on automated EBSD in the Scanning Electron Microscope (SEM). The technique has evolved into a mature analytical tool providing solutions for materials and earth scientists to determine the crystallographic microstructures of materials for applications such as preferred orientation analysis, grain size and shape, local deformation behavior, and phase identification and distribution.

TEAM™ EBSD

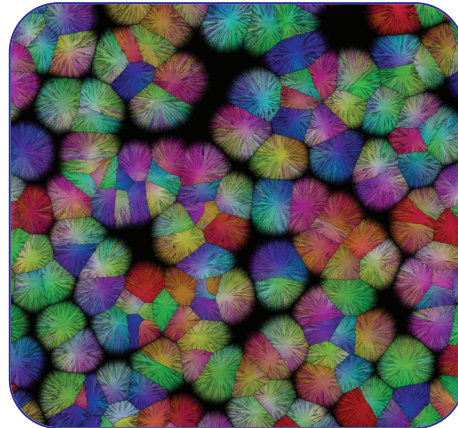
Powerful, easy to use environment for acquiring EBSD data in the SEM.

Features Include:

- A powerful, yet easy to use, suite of tools for interactive and automated collection and indexing of EBSD patterns from individual points or from a defined area of interest.
- Ability to analyze all crystal structures.
- Embedded camera and forward scatter detector imaging controls.
- High speed data collection with superior accuracy.
- Unique triplet indexing algorithms.
- Confidence Index (CI): patented verification of indexing accuracy.
- Patented ChI-Scan for superior multiphase analysis for improved indexing accuracy and phase.



EBSD image quality and phase map of olivine (blue), quartz (yellow), and enstatite (red) using ChI-Scan technology.



Orientation map of skutterudite film showing crystallization behavior.

EBSD Analysis

Virtually unlimited potential for interrogating the wealth of information contained in EBSD data.

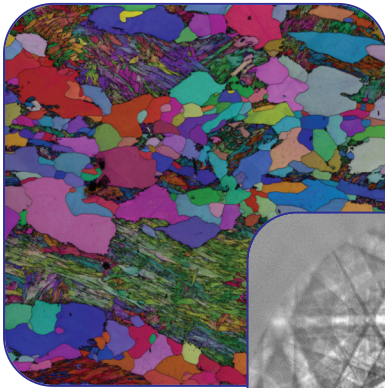
Features Include:

- Complete integration of analysis tools for easy cross-correlation of results.
- Customizable push-button solutions for commonly used analyses.
- Extensive array of maps, charts, and plots easily created and viewed.
- Texture analysis using advanced statistical tools.
- Advanced grain boundary analysis including twin boundary and boundary coherency analysis.
- Sophisticated and powerful data filtering and partitioning mechanisms.
- Interactive highlighting enables the correlation of key features between maps, charts, and plots.

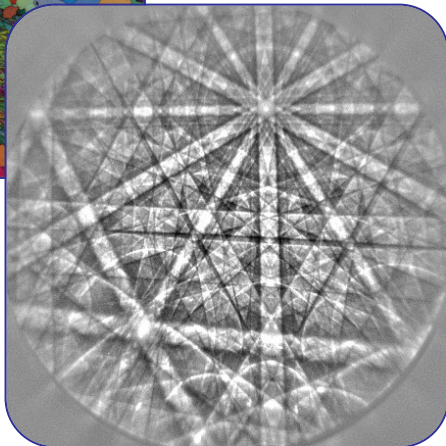
The Definitive Structural Analysis Solution

EBSD Hardware

EDAX offers detector solutions to meet all your EBSD needs for speed, sensitivity, and accuracy. All cameras include camera setting controls and forward scatter detector (FSD) imaging interfaces within TEAM™ EBSD. TEAM™ Smart Features optimize system setup for fast data collection enabling rapid characterization of crystalline microstructures.



EBSD image quality and orientation map of dual phase Ferrite-Martensite steel.



Diffraction pattern from Titanium Boride.

Hikari XP Camera

Completely integrated CCD-based detector optimized for high speed data collection.

Features Include:

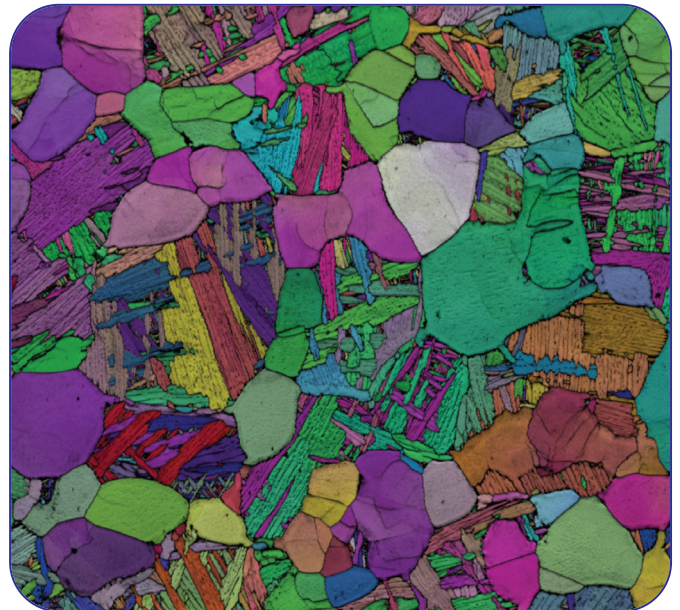
- Greater than 99% indexing success rate at 650 indexed patterns per second on Ni standard at beam currents of > 5 nA.
- Operation down to 100 pA beam current.
- Operation down to 5 kV accelerating voltage.
- Motorized, high-precision camera slide.
- Digital slide control for user-defined camera positioning and FSD optimization.
- Standard integrated Forward Scatter Detector.

DigiView Camera

Designed for a broad range of EBSD applications from pattern collection to high resolution imaging.

Features Include:

- Greater than 99% indexing success rate at speeds in excess of 150 indexed patterns per second on Ni standard at beam currents of > 5 nA.
- Pixel resolution: 1392 (H) X 1040 (V) pixels x 12 bit.
- Motorized camera positioning on slide.
- Optional integrated Forward Scatter Detector.



EBSD image quality and orientation map of Titanium.

The Ideal Complement for EDS Analysis

Why WDS?

Wavelength Dispersive X-ray Spectrometry (WDS) complements EDS to enhance qualitative and quantitative analysis from basic spectrum analysis to more complex mapping capabilities. The selectivity of WDS offers energy resolution superior to that of EDS, enabling the most difficult line overlaps to be resolved, detection limits to be reduced, and the precision of analysis to be improved.

Scanning Modes

WDS scans complement EDS spectrum collection to generate accurate qualitative and quantitative analysis.

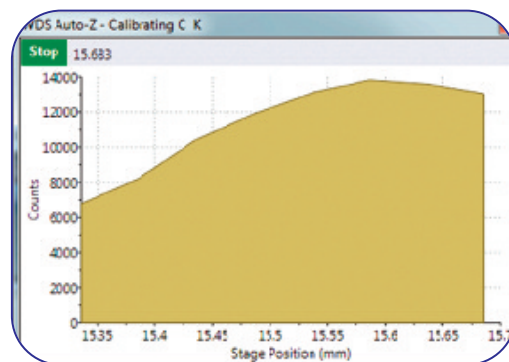
Scanning mode options include:

- Perform a scan over the entire energy range of the spectrometer.
- Select an energy range to suit the application.
- Select a region from an EDS spectrum.
- Peak and background mode for a selection of elements
 - Selected from a periodic table interface.
 - Software suggests diffractor, peak, and background positions.

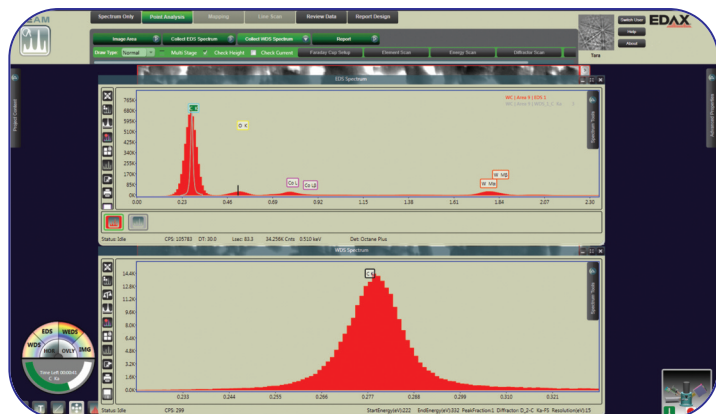
Smart Focus

Optimize sample position for maximum signal intensity.

A unique feature of the TEAM™ WDS Analysis System is the Smart Focus routine, which automatically adjusts the sample position to optimize the performance of the spectrometer (motorized Z axis control is required). This routine moves the stage in fine increments to find the maximum intensity.



Smart Focus automatically finds the sample position yielding double the available count rate for WDS.



“Collect WDS Spectrum” area with call out showing the various scan modes and options.

Qualitative and Quantitative Analysis

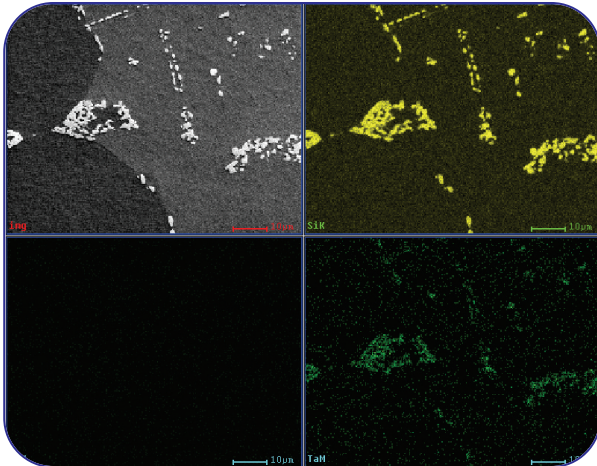
TEAM™ WDS with Smart Quant can easily generate data for simple qualitative analysis or complex quantitative calculations.

TEAM™ WDS provides the scientist with the tools to achieve the desired accuracy for qualitative and quantitative analysis. EDS and WDS data can be collected simultaneously and overlaid for easy qualitative confirmation. The analyst can select the data source per element (EDS or WDS) for quantitative calculations used to improve precision and detection limits.

The Ideal Complement for EDS Analysis

WDS Hardware

TEAM™ WDS Analysis System with wavelength dispersive X-ray spectrometers offers a compact parallel beam X-ray system (PBS), uniquely designed to fit all SEM chambers. The superior performance of the TEAM™ WDS system is due to the collection efficiency of the X-ray optics and the optimum design of the spectrometers.

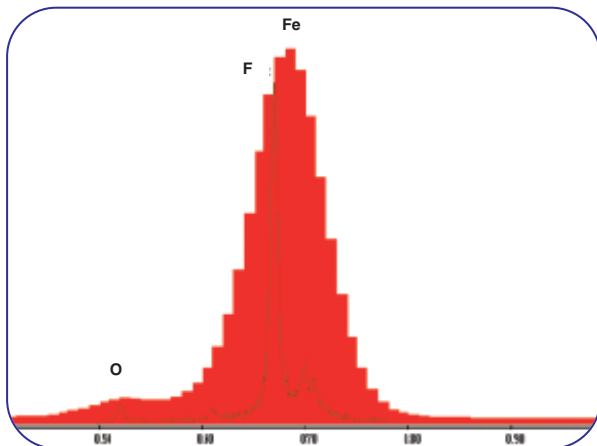


BSE image with Si K EDS map in top row with Si K and Ta M maps below illustrating actual presence of Ta rather than Si.

The TEAM™ WDS PBS

WDS spectrometers that think and act like an EDS system.

- Complete with five diffractors to satisfy the required energy ranges.
- Controlled via a simple user interface with all the parameters in energies.
- Combines EDS and WDS data for full elemental analysis.

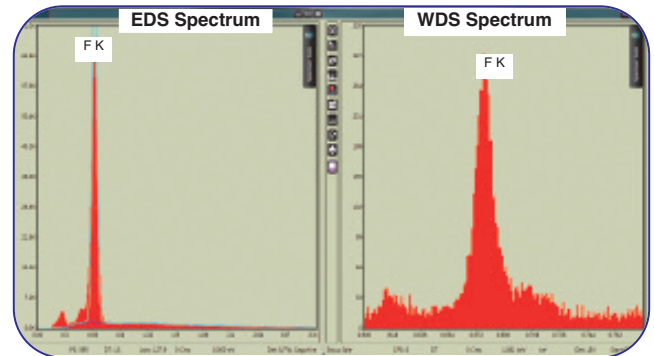


EDS spectrum in red and WDS spectrum in outline which clearly shows peak separation not possible with EDS alone.

The TEAM™ WDS X-ray Spectrometer Family

LEXS (Low Energy X-ray Spectrometer)

- Optimized for low energy X-ray microanalysis and incorporates the unique parallel beam high collection optics (HCO).
- Covers an energy range from 80 eV to 2.4 keV (Be K to S K).
- Automated sample positioning for ease of use.
- Provides the highest sensitivity for low energy X-rays of any WDS system available.
- Offers rapid X-ray analysis at the best resolutions obtainable.

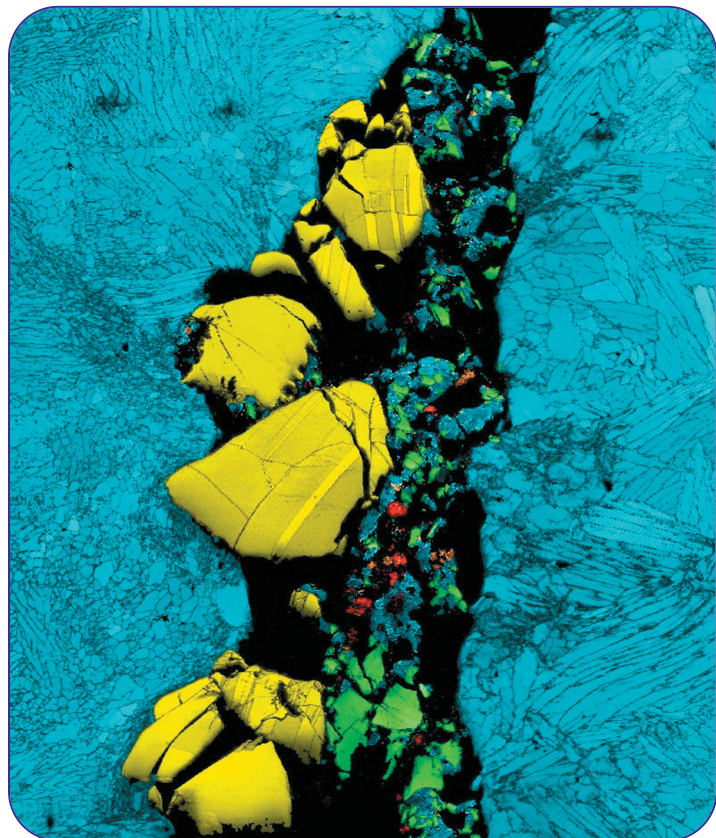


Individual EDS and WDS windows overlaid for quick comparison.

TEXS HP (Transition Element X-ray Spectrometer - High Precision)

- Optimized to cover low energy and transition element energies from 150 eV up to 10 keV (B K to Cu K).
- Automatically positions the optic and sample within +/- 1 μm for accurate quantification.
- Employs capillary optics to cover the energy range.
- Resolves most α/β overlaps of the transition elements.

Seamless Integration for EDS, EBSD and WDS



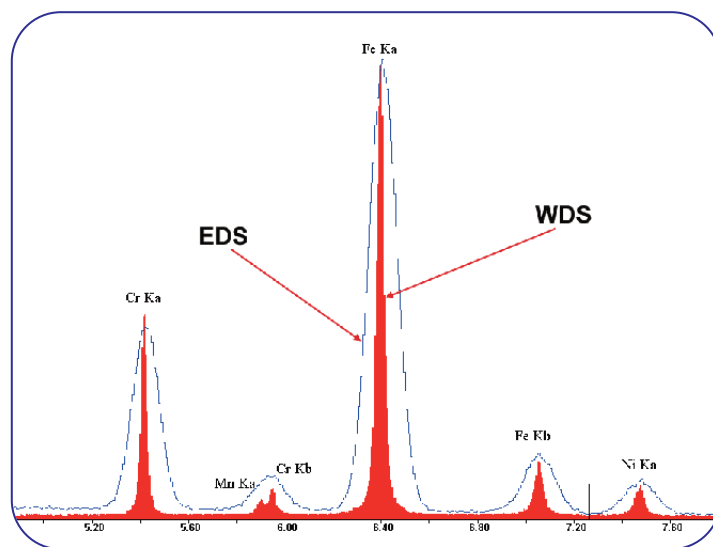
Example of phase map generated using EDAX's TEAM™ Pegasus system with the unique ChI-Scan capabilities to map multiphase complex materials.

TEAM™ Pegasus

Simultaneous data acquisition optimized for EDS (chemistry) and EBSD (crystallography), includes patented ChI-Scan technology to improve the analysis of complex multiphase materials.

TEAM™ Neptune

Complementary union of EDS and WDS microanalysis to improve chemical analysis for today's material scientist, where high resolution and precision are required.



Example of spectra illustrating the resolution improvements of WDS versus EDS using a stainless steel example.

TEAM™ Trident

Complete materials characterization system combining the trio of analytical tools: EDS, EBSD and WDS. Each tool is capable of operating independently to utilize EDAX's technological advancements or data can be integrated to provide solutions that were once unachievable.



Training and Support

All EDAX systems are fully supported by the EDAX worldwide service network with over 50 years of experience in global customer support. EDAX AMECARE Performance Services ensure peak performance and extend the operational life of our installed base of products. As part of the AMECARE program, customers are offered tiered service contracts structured to meet their needs and budgets. All programs are designed to yield maximum system uptime with predictable annual costs.

EDAX regularly holds customer training schools at our locations around the world. Whether you are new to EDS, EBSD, WDS or Micro-XRF, or looking to become more familiar with advanced applications, EDAX provides the most comprehensive training in the industry. Classes have a limited enrollment, providing an optimum environment for knowledge transfer and an opportunity to focus on specific individual training needs. For course information, visit our website:

www.edax.com

The EDAX ISO 9001 certification is another way of assuring our customers that quality is of the utmost importance. EDAX is committed to operational excellence and process improvement to provide our customers the very best in products and support.

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