Streamlining SEM Imaging and Microanalysis

ZEISS SmartEDX

The ZEISS EDS Solution Dedicated to Your Routine SEM Microanalysis Applications

zeiss.com/microscopy

ZEISS

Seeing beyond

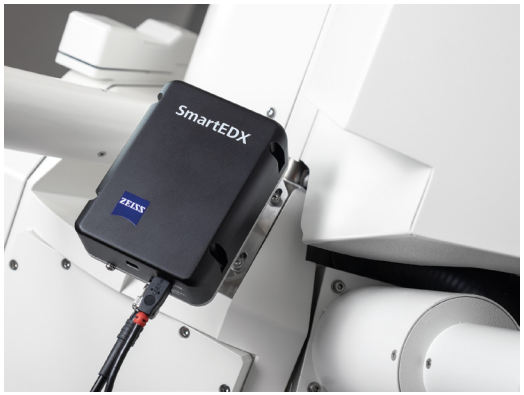
The ZEISS EDS Solution Dedicated to Your Routine SEM Microanalysis Applications

If SEM imaging alone isn't enough to gain a complete understanding of parts or samples, investigators will turn to Energy Dispersive Spectroscopy (EDS) to acquire spatially resolved elemental information from these surfaces.

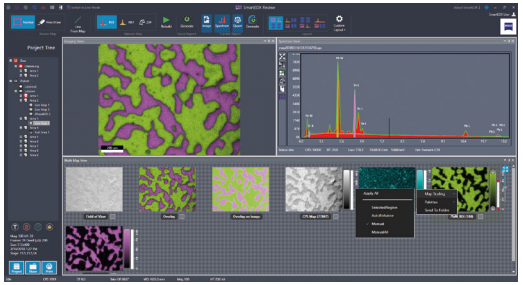
ZEISS SmartEDX is the dedicated microanalysis solution designed specifically for analytical routine applications performed on the ZEISS EVO Family and Sigma 300.

SmartEDX is one of the ZEISS' workflow-guided solutions, which are developed to improve both ease of use and workflow repeatability in multi-user environments.

ZEISS SmartEDX is ideal for customers with a vested interest in streamlining their number of analytical equipment suppliers. And because SmartEDX is supported entirely by ZEISS, you can trust your EVO or Sigma 300 equipped with SmartEDX to your ZEISS service engineer, who will take care of the entire system, both imaging and microanalysis alike.



ZEISS SmartEDX (fixed version): Peltier-cooled, ultra-compact design



Familiarity through consistency: Intuitive, workflow-guided graphical user interface

Simpler. More Intelligent. More Integrated.

Workflow-guided Graphical User Interface

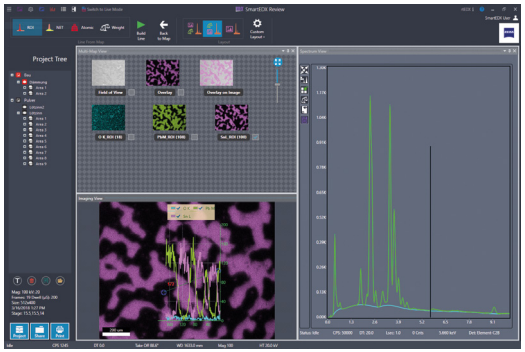
Like other ZEISS workflow-guided software solutions, such as SmartSEM Touch, ZEN core, or Shuttle & Find for EVO and Sigma 300, the SmartEDX software is easy to learn, intuitive to use, and helps ensure repeatable execution of analytical tasks on the SEM, particularly in environments where more than one operator will be using the system.

Resolution and throughput that are optimized for routine microanalysis applications

Not every SEM is alike, and the same is true for EDS solutions; thus, SEM and EDS have to be paired with careful consideration. SmartEDX provides highest (output count rate) throughput at 129 eV energy resolution and 1-5 nA probe current, which is the typical analytical operating condition for both ZEISS EVO and Sigma 300 Scanning Electron Microscopes. This makes SmartEDX a smart match to both our conventional and field emission analytical SEM workhorses.

Total system support

SmartEDX is supported like any other ZEISS component. All installation, preventive maintenance, warranty, diagnostics and repair, spare part logistics, and inclusion in total system service contracts are fully handled by ZEISS, making support of your analytical SEM solution easy.



ZEISS SmartEDX user interface

ZEISS EVO Scanning Electron Microscope with high vacuum and 30 kV beam acceleration capabilities

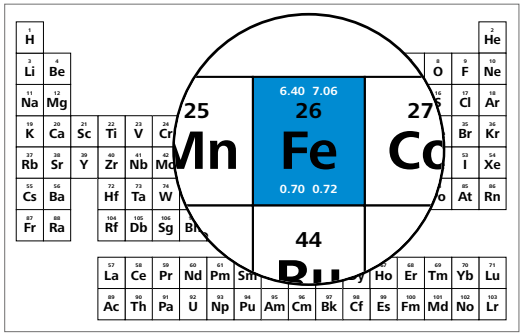
SmartEDX is supported entirely by ZEISS.

SmartEDX at Work: Quantitative Microanalysis

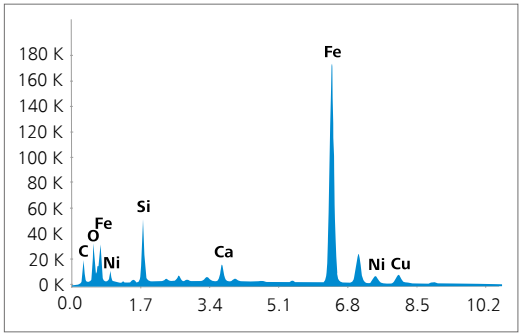
To acquire reproducible and accurate spatially resolved elemental chemistry requires careful consideration of both SEM and EDS operation conditions. Together, SmartEDX on either EVO or Sigma 300 is ideally suited for routine microanalysis applications, particularly for customers with high standards for data reproducibility.

SEM operating conditions

The SEM must have the ability to create a high vacuum environment in the specimen chamber to avoid scattering of the primary electron beam. Beam scatter compromises the spatial resolution of the elemental chemistry data. Furthermore, the SEM must be able to adjust the primary beam acceleration energy to sufficiently high values – up to 30 kV – for optimal signal to noise ratio of the peaks in the X-ray spectrum. ZEISS EVO and Sigma 300 solutions meet these requirements for delivery of the reproducible and accurate EDS data you require in your daily decision making.



Assess your choice of kV up to 30 kV from a periodic table with K and L-line energy values



Bulk spectrum from a mild steel component with a two-layer cosmetic coating, used for a quick assessment of the elements present in the sample

EDS operating conditions

SmartEDX has the versatility to provide 129 eV intensity peak (energy) resolution, as well as optimized detection of low energy X-rays from light elements thanks to superior transmissivity of the silicon nitride window on its X-ray detector.

Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
C K	10.97	29.41	443.27	9.22	0.0257	1.2026	0.1946	1.0000
O K	7.89	15.87	895.76	8.46	0.0240	1.1611	0.2621	1.0000
SiK	8.00	9.17	2282.76	6.70	0.0366	1.0737	0.4245	1.0028
CaK	2.39	1.92	782.66	2.52	0.0228	1.0250	0.9014	1.0351
FeK	61.18	35.26	13093.09	1.13	0.5725	0.9243	0.9998	1.0125
NiK	2.56	1.41	410.54	3.31	0.0217	0.9374	0.8921	1.0125
CuK	3.69	1.87	510.97	2.99	0.0305	0.8921	0.9125	1.0142

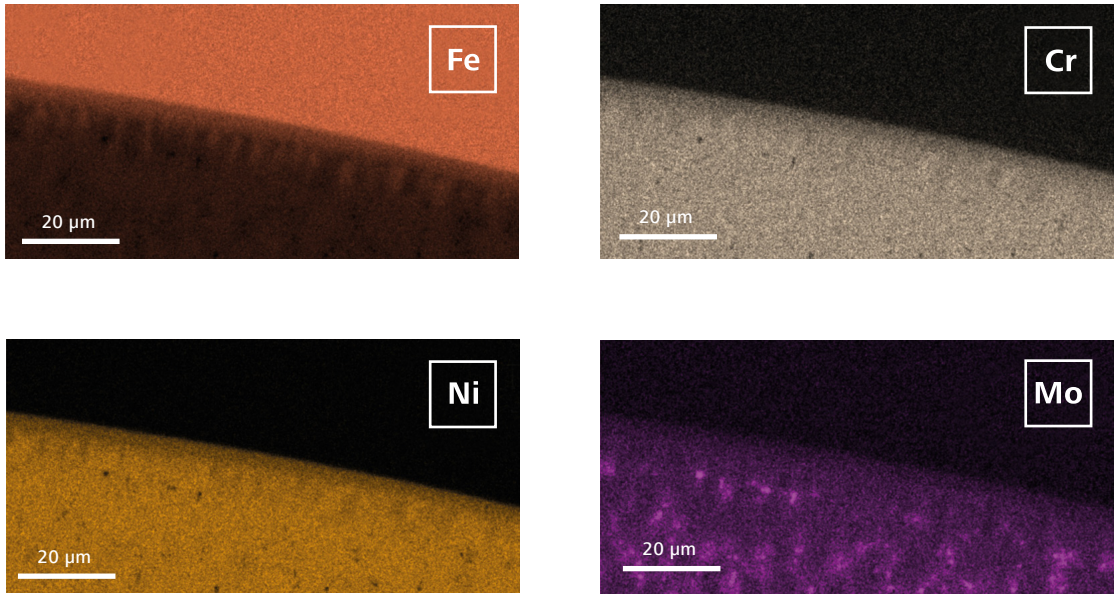
Smart quant results

SmartEDX at Work: Fast, Drift corrected, Elemental Mapping

All the capability you need to acquire elemental maps quickly and accurately
Elemental maps, line scans, and spectra can be displayed, interpreted, and quantified, based either on the widely used CPS map, or on advanced quantification algorithms, which of course include state of the art real-time ZAF corrections. The optimal balance between speed and energy resolution is just a mouse click away.

Drift correction is a standard SmartEDX feature, available for every collection mode. Fully automatic setting of all relevant parameters makes the usage of drift correction as intuitive as an eyeblink.

All this is complemented by Multipoint Analysis, which beside the possibility of a survey for quick and easy point sampling, allows saving and recalling of multipoint scan lists, for automated, reproducible, and consistent data collection.



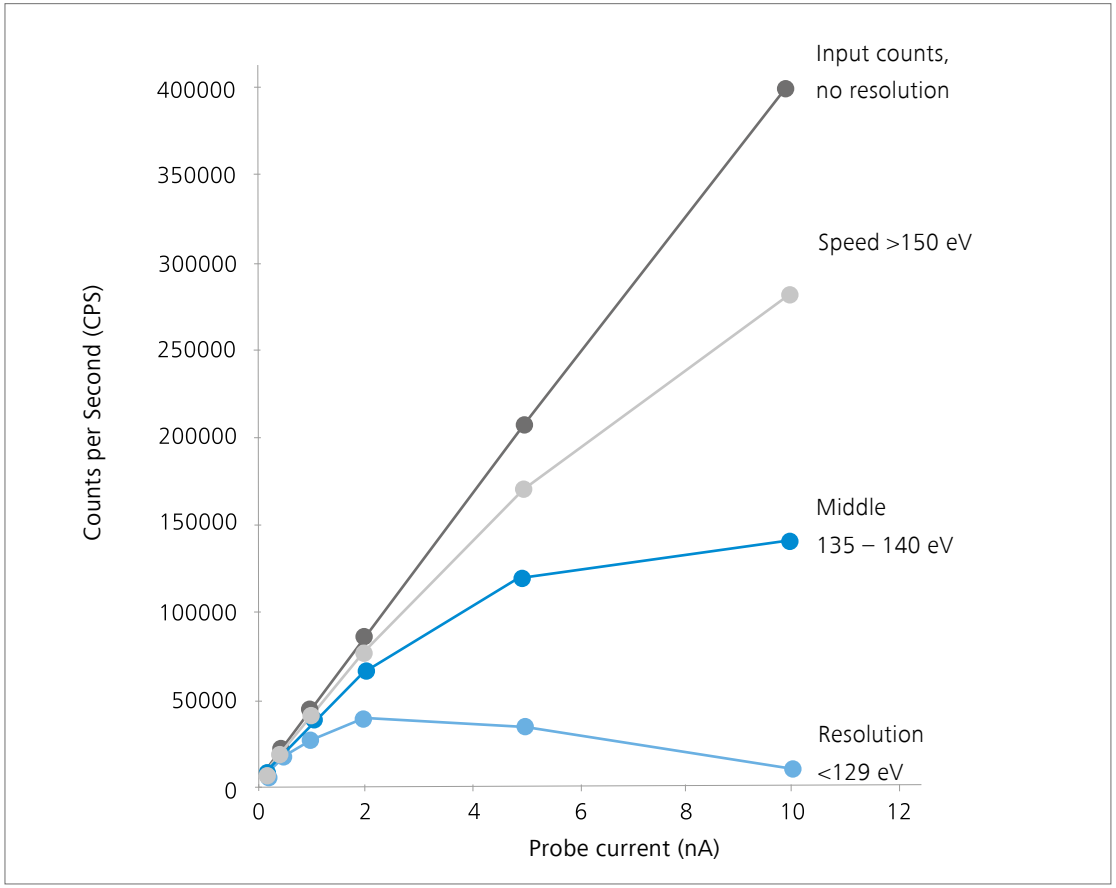
Dissimilar joint between low alloy steel and nickel alloy. Sample courtesy of TWI Ltd

The Technology that Drives Your Insights

Detector size tailored to routine microanalysis requirements

As practical throughput is controlled primarily by pulse processing, we've implemented a detector size that delivers optimum throughput at the probe current range required for the SEM system to perform at its best.

In conjunction with a solid-state backscattered electron detector, such as EVO or Sigma 300 HD-BSD, the practical probe current range is typically 1-5 nA. It is in this range where the 30 mm^2 detector of the SmartEDX system achieves the best compromise between highest input count rate and lowest possible dead time to deliver the highest throughput (output count rate) at 129 eV energy resolution. Throughput can be further enhanced, up to 300,000 output counts per second, by selecting one of two faster pulse processing settings, albeit at compromised energy resolution.

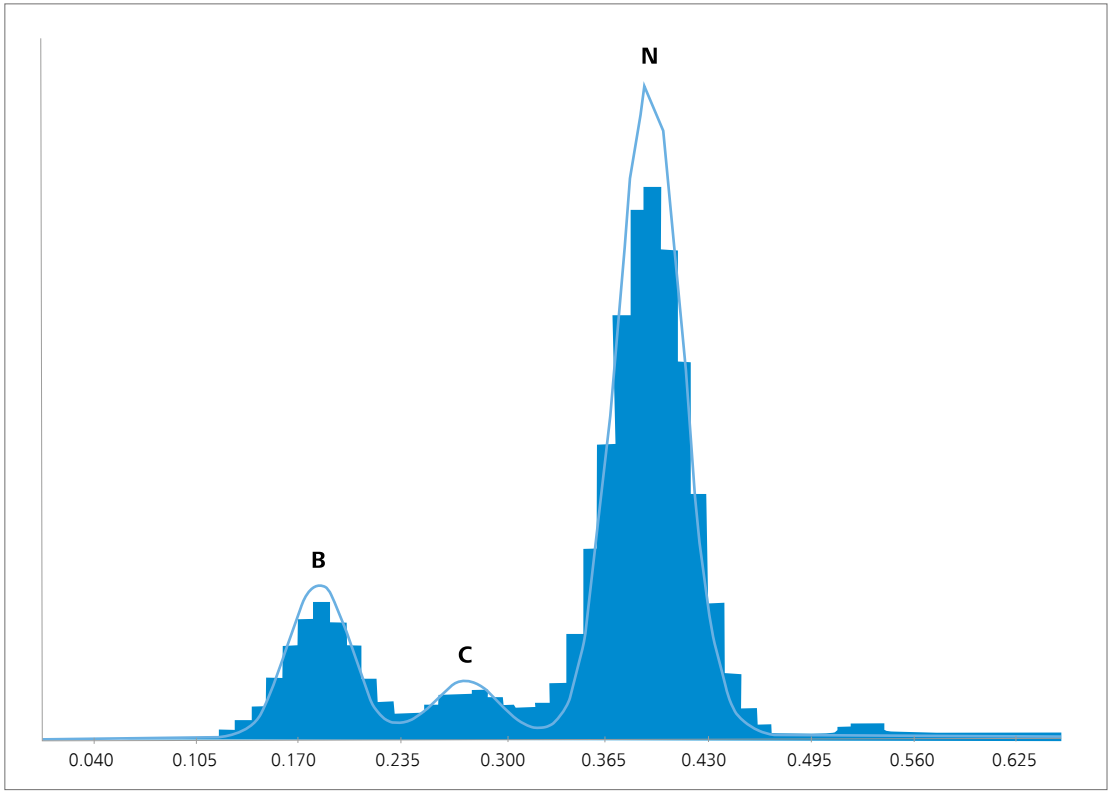


Output count rate versus probe current for three pulse processor settings

The Technology that Drives Your Insights

Silicon nitride window for light element detection

The detector of the SmartEDX solution is fitted with an ultra-thin silicon nitride window, which allows superior detection of low energy X-ray pulses from light elements such as carbon, nitrogen or oxygen. Detector energy resolution, specified at 129 eV for manganese K-alpha, extrapolates to approximately 60 eV for carbon, which ensures excellent separation of light element peaks in the spectrum.



EDS Spectrum from a carbon-coated Boron-Nitride sample, showing excellent separation and peak to noise background for the light elements Boron, Carbon and Nitrogen

Elemental and phase quantification

SmartEDX utilizes the industry-standard ZAF corrective algorithm for the interference effects of atomic number (Z), absorption (A) and fluorescence (F), in combination with predetermined X-ray intensity values for the different X-ray energies from elemental standards (referred to as standardless analysis).

In addition, SmartEDX enables the acquisition and storage of reference spectra. Spectra from unknown materials then can be matched against reference spectra from the library – a method referred to as spectrum matching – to aid in identification. This method is particularly useful for microanalysis applications where a relatively limited number of materials are utilized, as is often the case in manufacturing and assembly environments.

The Technology that Drives Your Insights

Fixed version for powerful analytical capability in a compact package:
Ease of use and fast results with optimum price performance ratio.

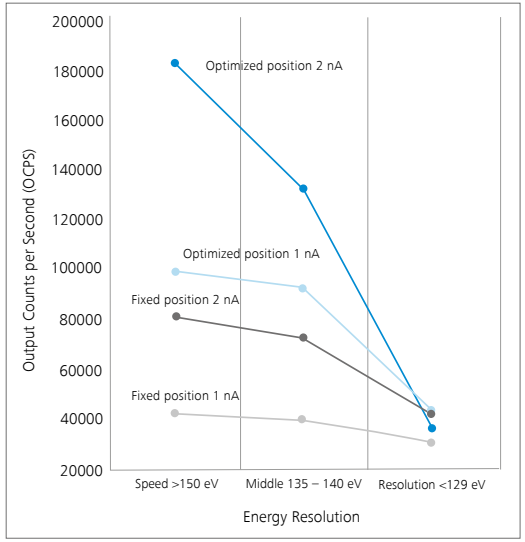
SmartEDX features a 30 mm^2 chip, adequate for all levels of analysis and high throughput for industrial applications. The detector excellent energy resolution is matched to an advanced low-noise electronics, for best in class performance and throughput.

The robust silicon nitride (Si3N4) window provided as standard on SmartEDX, allows larger transmissivity for low energy X-rays, a must for light element analysis, while at the same time ensures resistance to shock and corrosion, and full compatibility with plasma cleaning.

Retractable version to optimize detector position for your application:
Increase the input count rate by moving the detector closer to the sample.

Based on the same hardware as the fixed version of SmartEDX, this version can be retracted from its analysis position to a safe position where the detector is hard to hit by e.g. a large sample.

Movability helps if your samples are sensitive to the electron beam and cannot withstand long dwell times but a decent EDX is required, or if you like to perform higher resolution imaging. In both cases it is necessary to keep the spot size / probe current small and to maximize the input count rate.



The retractable version enables to keep low beam current and small spot size, without sacrificing the X-rays count rate. The input count rates collected in the optimized position are more than twice the counts of the fixed version of SmartEDX.

The Technology that Drives Your Insights

Detector	
Type	Silicon Drift
Cooling	Peltier (LN-free)
Active Area	30 mm^2
Window	Silicon Nitride (Si_3N_4)
Mount	Fixed or Slide (optional, recommended for particle analysis)
Detection Range	Be (4) to Am (95)

Pulse Processor	
Amplification Time	Three settings: Resolution, Middle and Speed
Best Energy Resolution	129 eV for Mn Ka
Input Count Rate (ICPS)	Up to 1.000.000 CPS
Output Count Rate (OCPS)	Up to 300.000 CPS (Speed amp time)
	Up to 40.000 CPS (Resolution amp time)

Key Features	
Peak Deconvolution	Included
Quantitative Analysis	Standardless, ZAF corrected. Spectrum Matching
Multipoint Analysis	Included
Elemental Linescan	Intensities (CPS) or Quant
Elemental Mapping	Intensities (CPS) or Quant
Drift Correction	Standard
Spectrum Matching	Optional

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