Advanced Test Equipment Corp.

www.atecorp.com 800-404-ATEC (2832)

PHENOM XL DESKTOP SEM

Desktop Scanning Electron Microscope

LARGEST SAMPLE STAGE

Load up to 36 half-inch stubs in a wide analysis area up to 100 mm X 100 mm.

AUTOMATED IMAGING & ANALYSIS

Leverage pre-built or custom Python scripts to automate imaging. Integrated Phenom ProSuite for automated image analysis.

SPECIALIZED SAMPLE STAGES

Motorized eucentric tilting and rotating, tensile testing, vacuum transferring, and resin mounting.

PHENOM XL DESKTOP SEM

The Phenom XL combines large sample capacity with an ultra-fast loading mechanism and automation to provide accurate, reproducible results and maximized throughput.

Large Samples

The system offers the ability to analyze large samples up to 100 x 100 mm at a resolution of 9 nm.

Speed to Data

The Phenom XL has an average time-to image of just 45 seconds - three times faster than other desktop SEMs on the market.

Long Lasting Source

A cerium hexaboride (CeB_6) crystal serves as a high-performance thermionic electron source, providing clearer images with sharper resolution and better contrast. This type of electron source is much more durable than traditional tungsten filaments, lasting over 50 times longer.

Fast Sample Exchange

A proprietary venting/loading mechanism ensures the fastest vent/load cycle in the world, providing the highest throughput.

Backscattered Electron Detector (BSD)

A four-segmented backscattered electron detector (BSD) that delivers sharp compositional contrast between light and heavy elements; is included as a standard feature in the XL.

Secondary Electron Detector (SED)

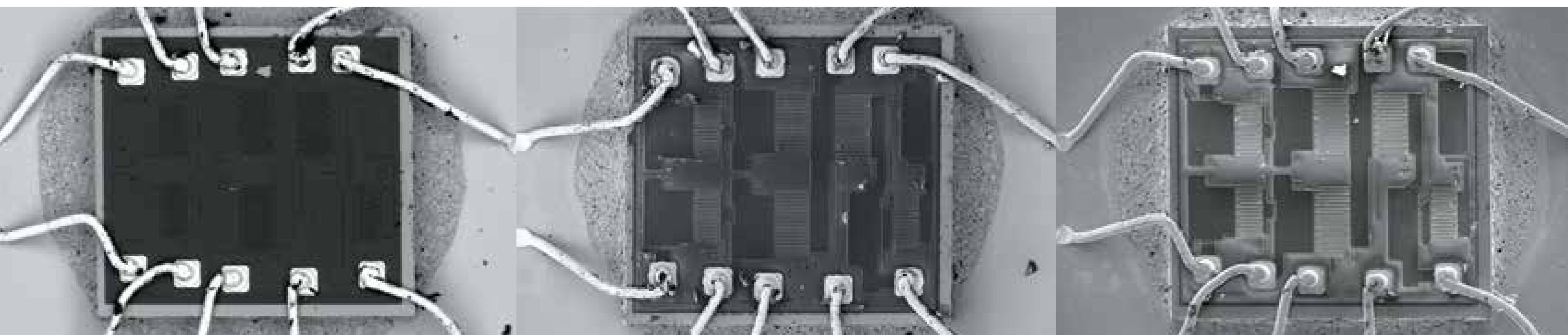
A secondary electron detector (SED), perfect for high-resolution, surface-sensitive SEM imaging, is available as an option.

Energy Dispersive X-ray Spectroscopy (EDS) Detector

An optional, fully-integrated energy dispersive spectroscopy (EDS) system enables elemental analysis at the same working distance as high-resolution imaging. The CeB_6 electron source achieves the highest X-ray count rate in its class for faster results.

Specifications	
Imaging Modes	
Light Optical	Magnification range: 5 - 31x
Electron Optical	Magnification range: up to 200,000x
Illumination	
Light Optical	Bright field / dark field modes
Electron Optical	Long lifetime CeB_6 source Multiple beam currents
Acceleration Voltages	2 kV, 5 kV, 10 kV, 15 kV, and 20 kV Advanced mode: adjustable range between 1.5 kV and 20.5 kV imaging and analysis mode
Vacuum Levels	Low (60Pa) - medium (10Pa) - high (0.1 Pa)
Resolution	<9 nm
Detectors	
Standard	Backscattered electron detector (BSD)
Optional	Secondary electron detector (SED)
	Energy Dispersive X-ray Spectroscopy (EDS) Detector
Digital Image Detection	
Light Optical	Proprietary high-resolution color navigation camera, single-shot
Electron Optical	High-sensitivity backscattered electron detector (compositional and topographical modes) Everhart-Thornley secondary electron detector (Optional)
Image Formats	
8-bit TIFF, 16-bit TIFF, JPEG, and PNG	
Image Resolution Options	
960x600, 1920x1200, 3840x2400, and 7680x4800 pixels	
Data Storage	
USB flash drive, network, or workstation with SSD	
Sample Stage	
Computer-controlled motorized X and Y	

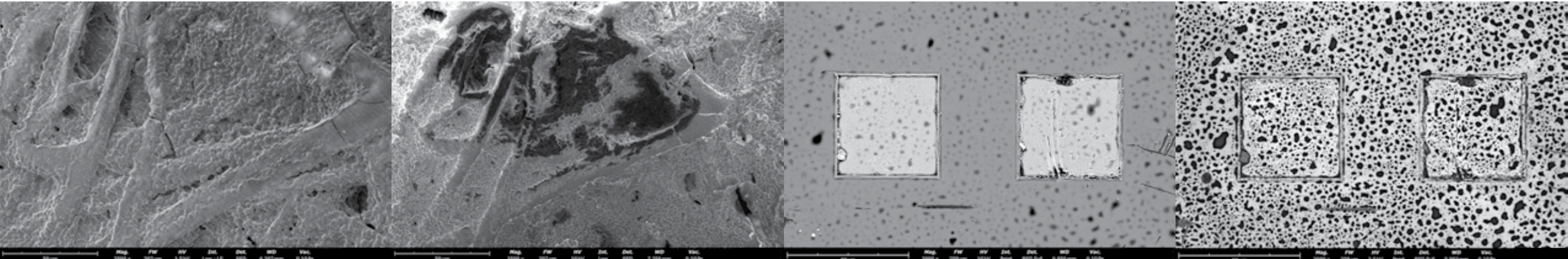
BSD image of microelectronics | *Mixed signal mode (33% BSD, 67% SED) image of microelectronics* | *SED image of microelectronics*



SUPERIOR LOW-kV IMAGING

The Phenom XL G3 delivers exceptional low-kV performance, providing high-contrast imaging down to 1.5 kV. The high-brightness CeB_6 source and advanced, high-sensitivity detectors provide several key advantages for low kV imaging:

- BSD imaging reveals thin features such as surface carbon contamination or tissue sections.
- Reduced beam damage to sensitive samples (ie. biological or polymers).
- Mitigate charging artifacts in nonconductive materials- no metal sputter coating needed.



SEM images of paper at 1.5 kV (left), which shows no charging effects, and 10 kV (right), which is affected by charging.

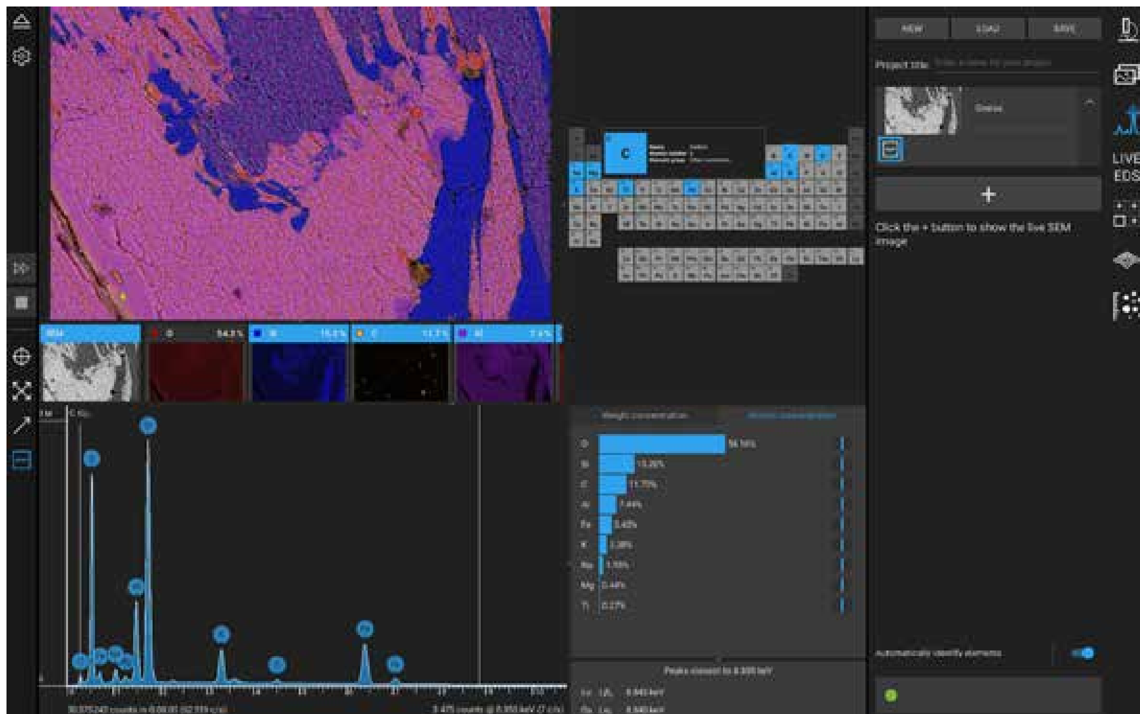
Silicon wafer with surface contamination seen through SEM imaging at 10 kV (left), where deeper beam penetration reduces surface details, and at 2 kV (right), where surface details are clearly visible.

ENERGY DISPERSIVE X-RAY SPECTROSCOPY (EDS)

The Phenom XL can be equipped with an optional EDS detector to obtain more material insights with element identification via x-ray analysis.

Element Identification (EID)

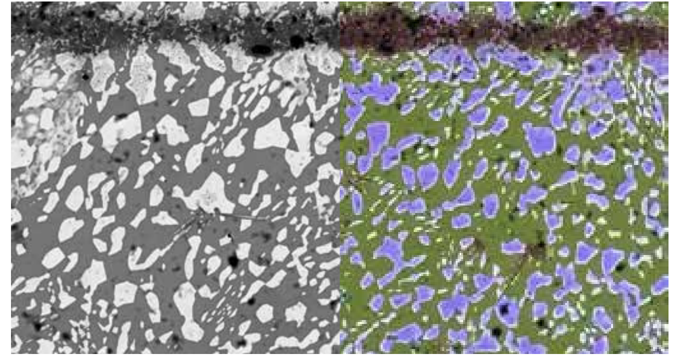
The dedicated EID software controls the fully integrated EDS detector and facilitates step-by-step data collection and analysis within the Phenom UI. With EID, you can identify nearly all elements from Boron (5) to Californium (98). It uses smart algorithms for automatic peak identification and deconvolution, with options for manual adjustments. The intuitive, interface organizes X-ray results effectively.



Phenom EDS Analysis UI showing results for a surface-polished Gneiss rock specimen.

ChemiSEM

ChemiSEM is a software capability that combines machine learning and ultrafast signal processing to display real-time elemental maps over live SEM images. This integration enhances the data acquisition experience by providing instant visualization of sample morphology and composition, making it easier to identify areas of interest, detect contaminants, and understand elemental distribution within samples.

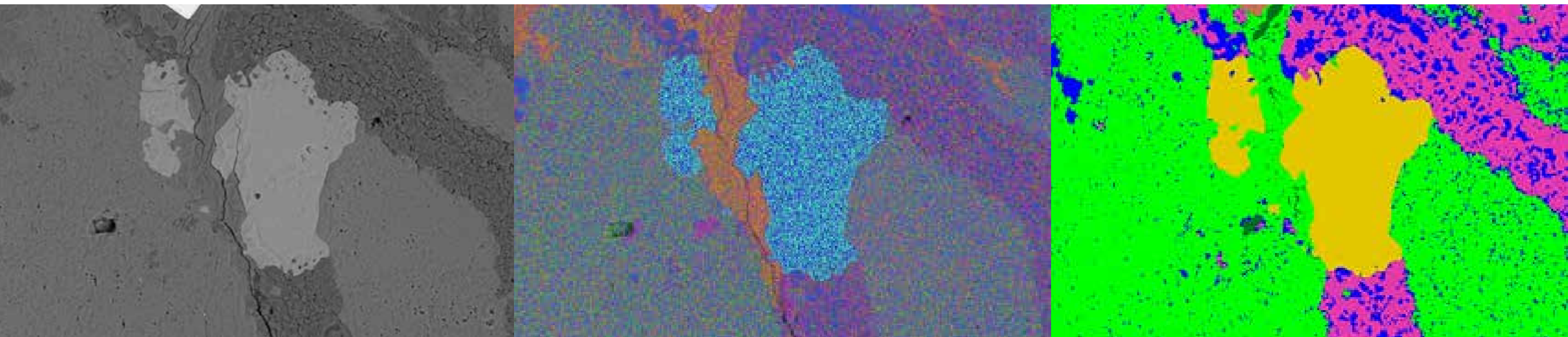


SEM image (left) and ChemiSEM image (right) of lead-tin solder.

ChemiPhase

ChemiPhase (phase mapping) is an advanced analysis tool that goes beyond standard EDS mapping. While EDS shows where individual elements are located, ChemiPhase groups areas with similar elemental compositions to identify distinct phases in a sample. This approach provides a clearer view of the sample's microstructure, highlighting regions with similar element percentages and offering deeper insights into the material's properties and behavior.

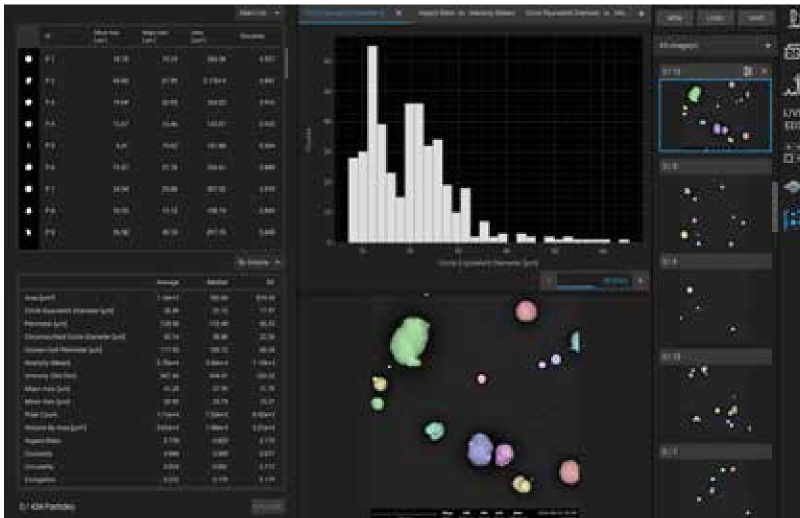
SEM image (left), EDS map image (center), and ChemiPhase map (right) of surface-polished rock specimen.



Elemental Mapping & Line Scan Specifications	
Elemental Mapping	
Elemental Selection	Individual user-specified maps, plus backscatter image and mix-image
Backscatter Image & Mix-range	
Selected Area	Any size, rectangular
Mapping Resolution Range	32x20 px - 960x600 px
Pixel Dwell Time Range	1 - 500 ms
Line Scan	
Line Scan resolution range	16 - 512 pixels
Line scan dwell time range	10 - 500 ms

EDS Specifications	
Detector Type	Silicon Drift Detector (SDD) Thermoelectrically cooled (LN_2 free)
Detector Active Area	25 mm^2
X-ray Window	Ultra thin silicon nitride (Si_3N_4) window allowing detection of elements B to Cf
Energy Resolution	Mn Kα ≤ 132 eV
Processing Capabilities	Multi-channel analyzer with 2048 channels at 10 eV/ch
Max. Input Count Rate	300,000 cps
Hardware Integration	Fully embedded
Software	
Integrated into Phenom User Interface Integrated column and stage control Auto-peak ID Iterative strip peak deconvolution Export functions: CSV, JPG, TIFF, ELID, EMSA	
Report	
DOCX format	

SOFTWARE



ParticleMetric UI

ProSuite

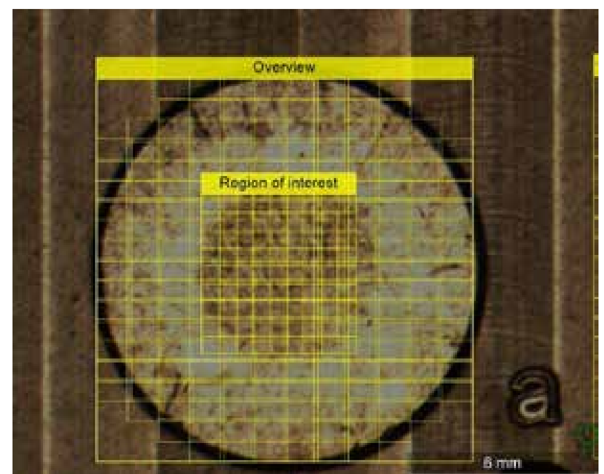
The ProSuite image analysis software is developed specifically for the Phenom SEM to deliver automated high throughput quantitative analysis of surface features while eliminating user bias. It includes **ParticleMetric** (particle size & shape analysis), **PoroMetric** (pore size and shape analysis), **FiberMetric** (fiber diameter and orientation analysis) and **3D Roughness Reconstruction** (to generate three- dimensional images).

Python Programming Interface (PPI)

Phenom Desktop SEMs benefit from Python compatibility, a feature that enables users to use custom scripts to control imaging workflows & data acquisition.

MAPS

MAPS software is a transformative tool for Phenom Desktop Scanning Electron Microscopes (SEMs), designed to boost both the efficiency and depth of your analytical workflows. MAPS features seamless image stitching – delivering high-resolution SEM images and EDS maps over expansive sample areas. MAPS also facilitates multi-modal correlative analysis across different analytical systems.



MAPS UI

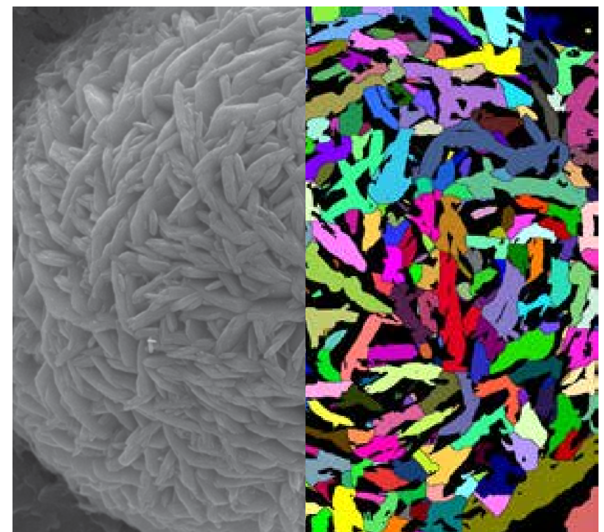
ParticleX with Perception

ParticleX transforms the Phenom XL Desktop SEM into a powerful tool for targeted data collection and analysis. With its automated SEM-EDS data collection and analysis workflows, ParticleX offers seamless quality control solutions that ensure unbiased results. Specific packages include:

1. **Technical Cleanliness (TC):** for pass/fail reporting regarding part cleanliness by automatically analyzing the size, shape, and elemental composition of up to 10,000 particles per hour for data-driven insights.
2. **Additive Manufacturing (AM):** for automatically characterizing the particle size distribution, particle morphology, and foreign particles.
3. **Steel:** for evaluating the size, shape, and composition of non-metallic particles and inclusions.
4. **Gunshot Residue (GSR):** for automated GSR analysis to quickly obtain reliable and accurate results.
5. **Battery:** for expedited analysis, authentication, and categorization of battery materials.

Avizo Trueput

Avizo Trueput is a dedicated battery quality analysis software designed to streamline battery inspection on the production floor. It converts SEM image datasets into clear, reproducible pass/fail reports. This powerful tool enables QA/QC teams to maximize efficiency and maintain quality standards.



Precursor primary particle analysis in Avizo Trueput

SAMPLE STAGES & INSERTS

Standard Sample Stage

The Phenom XL standard sample stage features a computer-controlled motorized movement in both the X and Y directions, allowing for precise sample positioning. It accommodates up to 36 half-inch samples or a larger bulk sample, providing versatility for various applications. With a generous analysis area of 100 mm x 100 mm, the stage is designed to support extensive, detailed examinations across multiple samples in a single session.

Eucentric Stage

6-axis stage allows samples to be tilted and rotated.

Tensile Testing Stage

In situ mechanical testing and imaging.

Resin Mount & Metallurgical Stage Inserts

Uniform working distance; quantitative EDS analysis.

System Specifications	
Dimensions (W x D x H) & Weight	
Imaging Module	316 x 587 x 625 mm; 75 kg
Diaphragm Vacuum Pump	145 x 220 x 213 mm; 4.5 kg
Power Supply	156 x 300 x 74 mm; 3 kg
Sample Size	
Max. 100 mm x 100 mm x 40 mm	
Holds up to 36 pin stubs (12 mm each)	
Max Stage Travel	
50 mm x 50 mm 100 mm x 100 mm (optional)	
Sample Loading Time	
Light Optical	<5 s
Electron Optical	<45 s

Requirements	
Ambient Conditions	
Temperature	15 °C ~ 30 °C (59 °F ~ 86 °F)
Power	Single phase AC 100 - 240 Volt, 50/60 Hz, 300 W (max.)
Recommended Table Size	
150 x 75 cm, load rating of 150 kg	

Nanoscience Instruments combines the expertise in microscopy and surface science instrumentation with real-world solutions. We partner with innovative instrument manufacturers around the world to help scientists and engineers solve complex problems, leading to breakthroughs and innovations. Our team of scientists and engineers are passionate about solutions and connecting our customers with the right products, maintenance, and analytical services to accomplish their goals.

ThermoFisher scientific develops and manufactures the best-in-class Phenom desktop scanning electron microscopy solutions (SEM) for high-quality imaging and analysis. They aim to make imaging and analysis at the nanoscale accessible to every scientist in every lab in the world. Towards this end, they focus on developing high-quality electron microscopy solutions that are functionally rich, yet simple to use.

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