

# Phenom XL G2 Argon-Compatible Desktop SEM

## Perform both preparation and analysis of air-sensitive battery materials in the same workspace

The Thermo Scientific Phenom XL G2 Argon-Compatible Desktop SEM allows SEM imaging and analysis within an argon-filled glove box.

The Thermo Scientific™ Phenom™ XL G2 Argon-Compatible Desktop SEM is the only SEM that can be placed in an argon filled glove box, allowing safer sample preparation and SEM EDS analysis within the same workspace. This setup enables research on air-sensitive battery samples since it decreases the risk of sample degradation due to lithium oxidation. By eliminating the need to move the research sample from one instrument to another, you can retain sample integrity, and save time and resources.

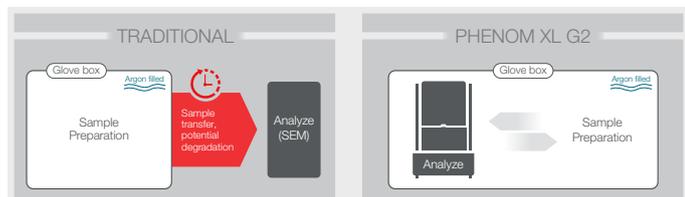


Phenom XL G2 Argon-Compatible Desktop SEM inside an argon-filled glove box.

### Element IDentification (EID)

The Phenom XL G2 Argon-Compatible Desktop SEM can be equipped with an optional EDS detector to obtain more material insights with element identification via X-ray analysis. Thanks to the design of the SEM column, high-resolution imaging is done at the same working distance as EDS analysis, resulting in an even faster workflow.

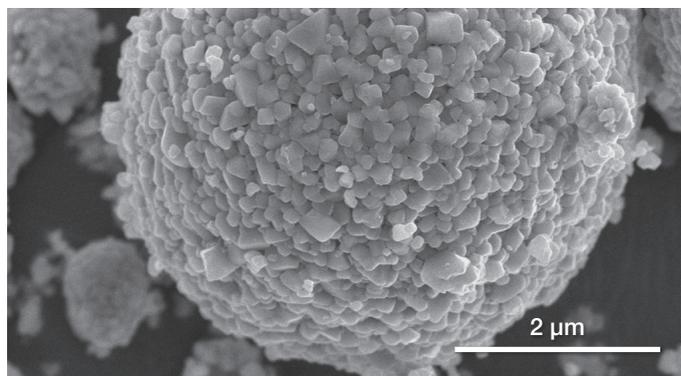
Live EDS gives you immediate element identification via point & click in imaging mode, while more advanced analysis, including the optional EDS line scan and EDS fast mapping, can be done via the integrated EID application.



Comparison of traditional process versus the Phenom XL G2 Desktop SEM, showing time efficiency and sample preservation.

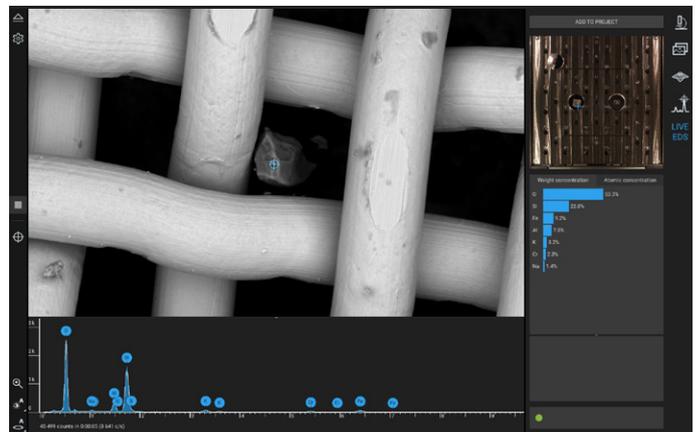
The all-new user interface is based on the proven ease-of-use technology already applied in the successful line of Thermo Scientific desktop SEMs. The workflow for analysis software is now integrated and operating the SEM has been made easier via the interactive databar and overlay structure. The interface enables both existing and new users to quickly become familiar with the system with minimal training.

The standard detector in the Phenom XL G2 Argon-Compatible Desktop SEM is a four-segment backscattered electron detector (BSD) that yields sharp images and provides chemical contrast information. The Phenom XL G2 Argon-Compatible Desktop SEM can be equipped with a fully integrated energy dispersive spectroscopy (EDS) system for elemental analysis. The Thermo Scientific ProSuite™ Software application platform is also available. With ProSuite Software and applications such as ParticleMetric, PoroMetric, FiberMetric and 3D Roughness Reconstruction, you can further analyze samples.



SEM image of battery cathode particles.

Imaging Specifications	
Imaging modes	
Light optical	Magnification range: 3–16x
Electron optical	Magnification range: 160–200,000x
Illumination	
Light optical	Bright field / dark field modes
Electron optical	<ul style="list-style-type: none"> <li>Long-lifetime thermionic source (CeB<sub>6</sub>)</li> <li>Multiple beam currents</li> </ul>
Acceleration voltages	Default: 5 kV, 10 kV and 15 kV Advanced mode: adjustable range between 4.8 kV and 15.0 kV imaging and analysis mode
Vacuum levels	Low - medium - high
Resolution	<10 nm
Detector	
Standard	Backscattered electron detector
Optional	Energy dispersive spectroscopy 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)
Image formats	
JPEG, TIFF, BMP	
Image resolution options	
960x600, 1920x1200, 3840x2400, and 7680x4800 pixels	
Data storage	
USB flash drive, network, workstation with SSD	
Sample stage	
Computer-controlled motorized X and Y	
Glovebox feethrough requirements	
<ul style="list-style-type: none"> <li>Ethernet</li> <li>Power</li> <li>USB</li> </ul>	



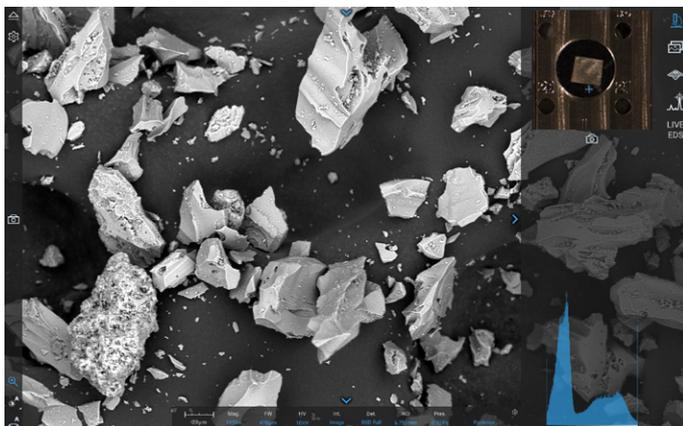
EDS analysis of a particle inside a metal mesh.

### Step-by-step data collection

The dedicated Element Identification (EID) software package is used to control the fully integrated EDS detector. Analysis has become as easy as imaging, since there is no need to switch between external software packages or computers. The CeB<sub>6</sub> electron source is used to generate the highest X-ray count rate in its market segment, resulting in short acquisition times.

The EID software package allows you to identify nearly all materials in the periodic table, starting from Boron (5) and ranging up to Californium (98). It is a perfect analysis tool for a wide range of samples and applications. Projects can be stored locally or on the network, where they can be analyzed at a later stage or offline.

The EID software package runs smart algorithms with advanced peak analysis to optimize the auto-identification functionality, while still allowing for manual adjustments at any time in the analysis process. The intuitive step-by-step process within the software helps you to collect all X-ray results in an organized and structured way.



Intuitive user interface.

### EDS specifications

Detector type	<ul style="list-style-type: none"> <li>Silicon Drift Detector (SDD)</li> <li>Thermoelectrically cooled (LN<sub>2</sub> free)</li> </ul>
Detector active area	25 mm <sup>2</sup>
X-ray window	Ultra-thin silicon nitride (Si <sub>3</sub> N <sub>4</sub> ) window allowing detection of elements B to Am
Energy resolution	Mn Kα ≤132 eV
Processing capabilities	Multi-channel analyzer with 2,048 channels at 10 eV/ch
Max. input count rate	300,000 cps
Hardware integration	Fully embedded

### Software

- Max. 100 mm x 100 mm scan area
- Integrated in ProSuite Software
- Integrated column and stage control
- Auto-peak ID
- Iterative strip peak deconvolution
- Confidence of analysis indicator
- Export functions: CSV, JPG, TIFF, ELID, EMSA

### Report

Docx format

### System specifications

#### Dimensions and weight

Imaging module	316(w) x 587(d) x 625(h) mm, 75 kg
Diaphragm vacuum pump	145(w) x 220(d) x 213(h) mm, 4.5 kg
Power supply	156(w) x 300(d) x 74(h) mm, 3 kg
Monitor (24")	531.5 (w) x 250 (d) x 515.4 (h) mm; 6.7 kg

- Powerful workstation, including SSD storage and 4 USB slots
- 92.5 (w) x 305.6 (d) x 343.5 (h) mm, 8 kg

#### Sample size

- Max. 100 mm x 100 mm (up to 36 x 12 mm pin stubs)
- Max. 40 mm (h)

#### Scan area

- 50 mm x 50 mm
- 100 mm x 100 mm (optional)

#### Sample loading time

Light optical	<5 s
Electron optical	<60 s

### Requirements

#### Ambient conditions

Temperature	15–25°C ambient (59–77°F)
PPM levels H <sub>2</sub> O / O <sub>2</sub>	<0.5 PPM tested
Power	Single phase AC 100–240 Volt, 50/60 Hz, 163 W average, 348 W max

#### Physical parameters

- 150 x 75 cm, load rating of 150 kg
- Pre-vacuum pump has to be mounted vibration free

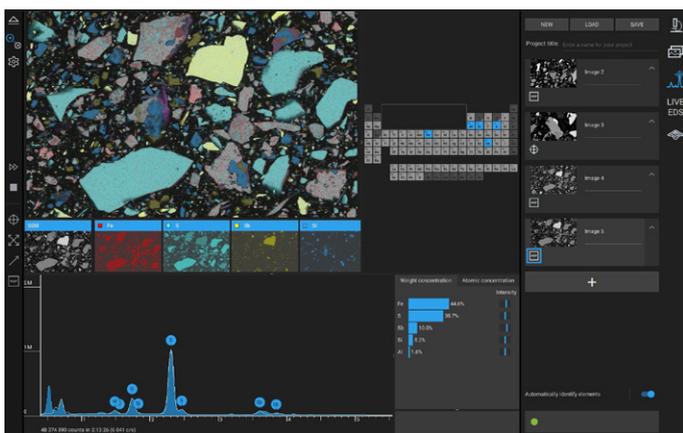
### Alternative conditions

#### Ambient conditions

In addition to an argon environment, the Phenom XL G2 Argon-Compatible Desktop SEM is tested and approved for use under dry room conditions with a dew temperature of -65°C (-85°F)

#### Relative humidity

Less than 0.05% RH at 25°C (77°F) ambient temperature



EDS mapping of geological sample.

### Automation

The Phenom XL G2 Desktop SEM is standardly accessible via PPI (Phenom Programming Interface), a powerful method to command the Phenom XL G2 Desktop SEM via Python scripting. If you have an SEM workflow with repetitive tasks to analyze particles, pores, fibers, or large SEM images, you can allow the Phenom XL G2 Desktop SEM to do this for you automatically. If required, we can offer support on your specific use case.

### CeB6 long-life source

The CeB6 (cerium-hexaboride) long-life source has several advantages. First, the high brightness it provides, compared to tungsten, makes it much easier for many users to obtain high-quality images with many details. Second, the lifetime of the source is very long, allowing the glove box to be closed as long as possible, and maintenance can be scheduled. This enables you to obtain the results you seek, even after a long, automated run.

The lifetime is extended as much as possible via our intelligent software; the source is hibernated when the Phenom XL G2 Desktop SEM is unused. In case the source needs to be replaced, this can be done on-site.

### Eucentric Sample Holder

In many SEM applications, you can gain more insight into sample properties if the sample can be tilted and rotated. The Eucentric Sample Holder has been specifically developed with that in mind. The holder contains a sub-stage that allows you to easily and safely look at a sample from all sides.

Learn more at [thermofisher.com/phenom-xl](https://thermofisher.com/phenom-xl)

## Elemental Mapping and Line Scan specifications

### Elemental Mapping

Element selection	Individual user-specified maps, plus backscatter image and mix-image
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### Backscatter image and mix-range

Selected area	Any size, rectangular
Mapping resolution range	32x20–960x600 pixels
Pixel dwell time range	1–500 ms

### Line Scan

Line Scan resolution range	16–512 pixels
Line scan dwell time range	10–500 ms

### Report

Docx format

## Eucentric Sample Holder specifications

### Automated movements

In 4 directions: Z (height), R (rotation), T (tilt) and x' (x-prime)

### Maximum sample size

90° tilt	Ø ≤30 mm; height ≤32 mm
<45° tilt	Ø ≤70 mm; height ≤32 mm

### Tilt angle

Between -15° and +90°

### Rotation

360° continuous