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DATASHEET

Phenom ParticleX AM Desktop SEM

Multi-purpose desktop SEM delivering purity at microscale

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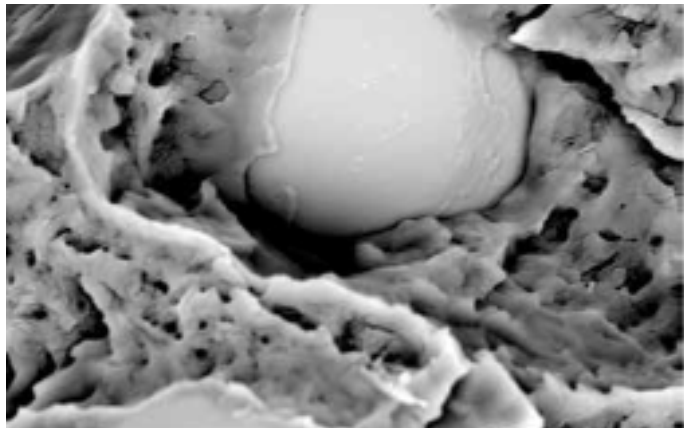
SEM image of Zinc-Phosphate on sheet metal.



SEM image of undesired particle within polymeric matrix.

A growing number of manufacturing companies are establishing scanning electron microscopy (SEM) systems in-house. This trend, from outsourcing to in-house analysis, is growing and the benefits, such as the ability to perform a broad range of automated desktop analyses, chemical classification and verification according to specific norms are clear.

Timely and accurate quality control are prerequisites for today's manufacturing. The Thermo Scientific™ Phenom™ ParticleX Desktop SEM is a versatile solution for high-quality analysis in-house. It gives you the ability to carry out speedy analysis, verification and classification of materials, supporting your production with fast, accurate and trusted data. The system is automated and offers multiple sample analysis, making testing and classification up to 10 times faster. Outsourcing typically takes up to 10 working days, whereas the Phenom ParticleX Desktop SEM gives you certainty within one day. The system is simple to operate and fast to learn, opening up the use of particle and material analysis to a wider group of users in-house. In addition to eliminating the need to outsource, the ease-of-use and automation of the Phenom ParticleX Desktop SEM allows you to offload sample analysis from other SEMs in your laboratory.

The Phenom ParticleX Desktop SEM not only provides high quality SEM analysis, it is also designed to perform a number of specific functions. These include particle analysis of metal powders at the microscale for the additive industry, and confirming that components fulfill technical cleanliness specifications according to VDA19 or ISO16232 standards. All now made possible in-house and on your desktop

Phenom ParticleX Desktop SEM: general SEM usage

The Phenom ParticleX Desktop SEM features a chamber which includes an accurate and fast motorized stage that allows analysis of samples of up to 100 mm x 100 mm. In spite of this larger sample size, a proprietary loading shuttle keeps the vent/load cycle to an industry-leading sample loading time of 40 seconds or less. In practice this improves the throughput factors higher than other SEM systems.

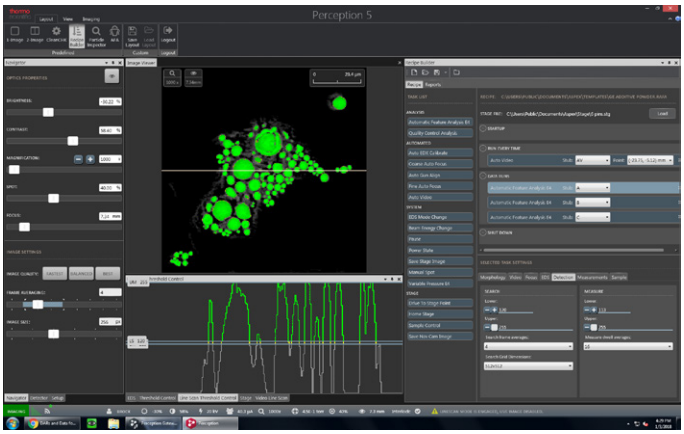
The user interface is based on the proven ease-of-use technology applied in the successful Phenom desktop SEM products. The interface enables both existing and new users to quickly become familiar with the system with a minimum of training.

The standard detector in the Phenom ParticleX Desktop SEM is a four-segment backscattered electron detector (BSD) that yields sharp images and provides chemical contrast information together with a fully integrated energy dispersive X-ray (EDX) system for elemental analysis. A secondary electron detector (SED) for surface sensitive imaging is optional.

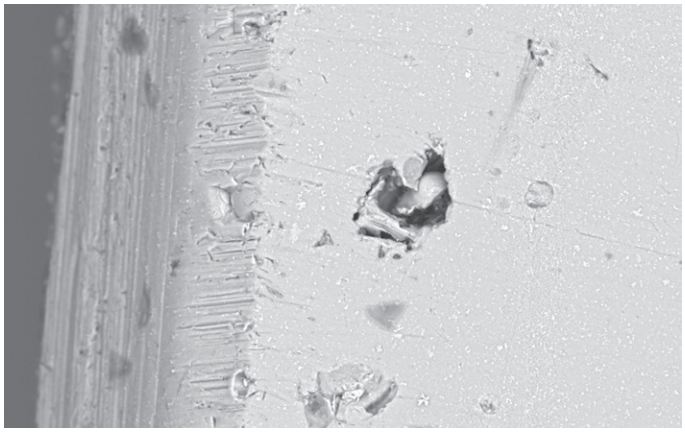
Elemental analysis is provided by EDX technology, which allows users to analyze the chemical composition of their samples. Detailed chemical composition can be obtained from a micro volume via a spot analysis. Elemental distribution can be visualized with the elemental mapping option.

Elemental mapping and line scan

For the user, it is simply click and go to work with the elemental mapping and line scan functionality of the Phenom ParticleX Desktop SEM. The elemental mapping functionality visualizes the distribution of elements throughout the sample, and selected elements can be mapped at a user-specified pixel resolution and acquisition time. The real-time mapping algorithm shows live build-up of the selected elements. The line scan functionality shows the quantified element distribution in a line plot. This is especially useful for coatings, paints and other applications with multiple layers for analyzing edges, coatings, cross sections and other. Results of both the elemental mapping and line scan functionality can be easily exported by using an automated report template.



Specific parameters can be individually set.



Poor powder characteristics can lead to 3D-printed failures.

Secondary electron detector

A secondary electron detector (SED) is optionally available on the Phenom ParticleX Desktop SEM. The SED collects low-energy electrons from the top surface layer of the sample, making it the perfect choice to reveal detailed sample surface information. The SED can be of great use for applications where topography and morphology are important. This is often the case when studying microstructures, fibers or particles.

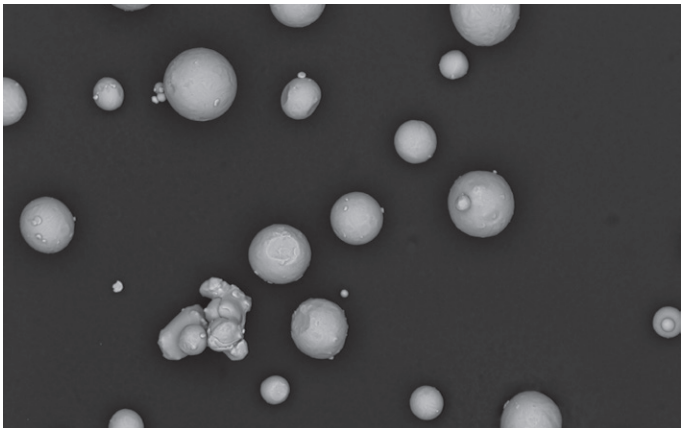
Phenom ParticleX Desktop SEM- additive manufacturing

The Phenom ParticleX Desktop SEM for additive manufacturing enables automated Scanning Electron Microscopy with EDX Spectrometry. It is the proven solution for monitoring the three most critical characteristics of metal powders for powder-bed and powder-fed additive manufacturing processes: monitoring particle size distributions, revealing individual particle morphology and identifying foreign particles.

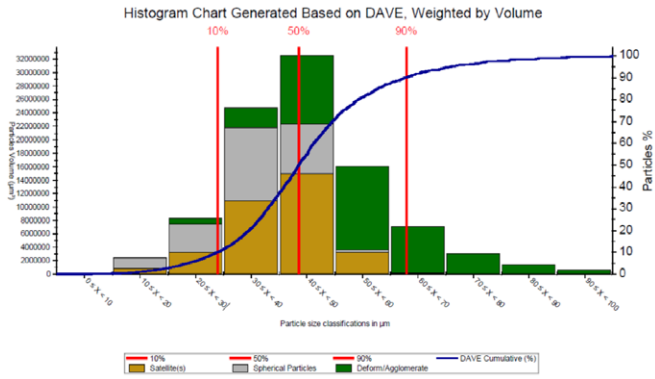
The Phenom ParticleX Desktop SEM for additive manufacturing measures various size and shape parameters, such as minimum and maximum diameter, perimeter, aspect ratio, roughness, and feret diameter. All of which can be displayed with 10%, 50%, 90% values (e.g. d10, d50, d90).

The supplied analysis recipes allows you to differentiate between satellite particles, spherical particles and deformed particles. Particles Size Distributions can be plotted as number-based or volume-based.

The integrated EDX allows chemical typing of each individual particle, allowing you to readily identify any foreign particulate in your powder from previous printing cycles.



Detect particles, satellites and conglomerates.



Plot powder size distributions as volume-based or number-based.

Imaging Specifications

Imaging modes

Light optical	Magnification range: 3 - 16x
Electron optical	• Magnification range: 160 - 200,000x • Digital zoom max. 12x

Illumination

Light optical	Bright field / dark field modes
Electron optical	• Long lifetime thermionic source (CeB_6) • Multiple beam currents
Acceleration voltages - Phenom UI	• Default: 5 kV, 10 kV and 15 kV • Advanced mode: adjustable range between 4.8 kV and 20.5 kV imaging and analysis mode
Vacuum levels	Low - medium - high
Resolution	<10 nm
Acceleration voltages Technical cleanliness EDX analysis	15 kV

Detector

Standard	• Backscattered electron detector • Energy Dispersive Spectroscopy detector
Optional	Secondary electron 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, 7680x4800 pixels

Data storage

USB flash drive, Network, Workstation

Sample stage

Computer-controlled motorized X and Y

Sample size

- Max. 100 mm x 100 mm (up to 36 x 12 mm pin stubs)
- Max. 40 mm height (optional up to 65 mm)

Scan area

- 100 mm x 100 mm

Sample loading time

Light optical	<5 s
Electron optical	<60 s

EDX Specifications

Hardware

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 Am
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 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

Elemental Mapping & Line Scan Specifications

Elemental Mapping

Element selection	10 individual user specified maps, plus backscatter image and mix-image

Backscatter image and mix-range

Selected area	Any size, rectangular
Mapping resolution range	16 x 16 - 1024 x 1024 pixels
Pixel dwell time range	1 - 250 ms

Line Scan

Line Scan resolution range	16 - 512 pixels
Points dwell time range	50 - 250 ms
Total number of lines	12

Report

Docx format

SED Specifications

Detector type

Everhart Thornley

System Specifications	
Dimensions & 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	531.5(w) x 515.4(h) x 250(d) mm, 6.7 kg
Workstation	169(w) x 456(d) x 432(h) mm, 15 kg
Requirements	
Ambient conditions	
Temperature	15°C ~ 30°C (59°F ~ 86°F)
Humidity	20% < RH < 80%
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	
Workstation Specifications	

- Lenovo workstation
- i5-9500 (6 cores)
- 16 Gb RAM
- 512 Gb SSD
- Keyboard, mouse
- Microsoft Windows® 10

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Notes

Find out more at **thermofisher.com/phenom-particle-x-am**

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