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Axia ChemiSEM
Instant fusion of chemistry and imaging

The Axia ChemiSEM is the next generation of SEM. Always ready to image and with live quantitative chemical mapping, the Axia ChemiSEM is the first choice for rapid analysis—even for users new to scanning electron microscopy.

The Thermo Scientific™ Axia™ ChemiSEM is a reimagining of the SEM–EDS workflow. It introduces a new way of acquiring, processing, and presenting the compositional information of a sample. Unlike traditional EDS analyses, the Axia ChemiSEM uses the secondary and backscatter electron signals to accelerate the EDS analysis, resulting in a faster time to data and results with less noise. The Axia ChemiSEM introduces a streamlined implementation for both hardware and software, providing real-time chemical analysis. Imaging and chemical analysis of samples has never been easier, faster, or more accurate.

Live quantitative elemental mapping
The Axia ChemiSEM generates fully quantitative, element X-ray maps, eliminating the artifacts associated with traditional gross count mapping such as peak overlaps and background variation. A proprietary shadow detection algorithm assists in providing information only from regions where X-rays are detected, while DCFI-based drift correction* ensures the image and analytical data are always sharp. Reliable results are a reality for operators of all experience levels.

Easy to get started
The Axia ChemiSEM incorporates unique column technology, enabling sample-focused data collection. A novel user interface with integrated user guidance seamlessly blends SEM and EDS modalities, instantly alerting you to areas of interest based on chemistry. The integrated EDS system automatically adjusts to changes in working distance, accelerating voltage, beam current, and magnification, freeing you to focus on the task at hand. The Axia ChemiSEM enables the highest sample throughput, ease of analysis, and better data collection.

Key Benefits

Live compositional information: Performs EDS by acquiring multiple signals simultaneously, detecting the morphology and elemental makeup of a sample, in real time

Always-ready-to-image platform: Lets you stay focused on data collection

Improved time to data: Offers several imaging and scanning strategies to optimize image acquisition and increase throughput

Flexible stage: Provides large sample capacity with a door that provides access to the entire chamber, as well as a stage with a capacity of 10 kg

Excellent imaging performance: Offers optional low-vacuum mode and charge-mitigation using beam deceleration mode
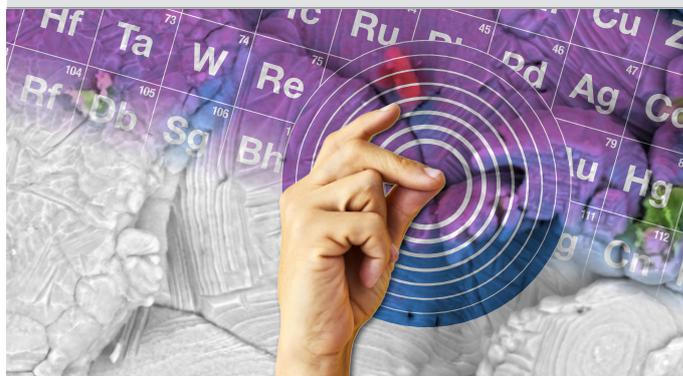

Flexible sample loading
The Axia ChemiSEM offers new levels of robustness and flexibility. It has a large sample capacity and a design that provides easy access to the entire chamber. The Axia ChemiSEM accommodates the very high weight of up to 10 kg, saving time cutting samples and reducing time-consuming sample preparation.

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Excellent imaging performance

The Axia ChemiSEM offers remarkable all-round performance for characterization of the widest range of materials. It includes a full detector suite for SE, BSE, and EDS data collection. When configured with the optional low-vacuum mode, the Axia ChemiSEM includes a LoVac SE as standard, with the ability to adjust the pressure up to 150 Pa. The low-vacuum mode is ideal for analyzing non-conductive samples, as it enables charge-free imaging, with an increase in the material contrast, allowing the use of higher beam currents to perform faster chemical analyses.

Advanced software options

The Axia ChemiSEM can be configured with a variety of software options for full system automation. Thermo Scientific AutoScript™ Software allows for customized workflow development, interfacing directly with Python 3.x tools. Thermo Scientific Maps™ Software enables automated large-area analysis with tiling and stitching for correlative workflows. Thermo Scientific TopoMaps Software enables image colorization, image analysis, and 3D surface reconstruction. Automated particle analysis and classification can be performed based on our Perception software. Full off-line EDS data analysis is available via ChemiView software to free up the Axia ChemiSEM for data acquisition.
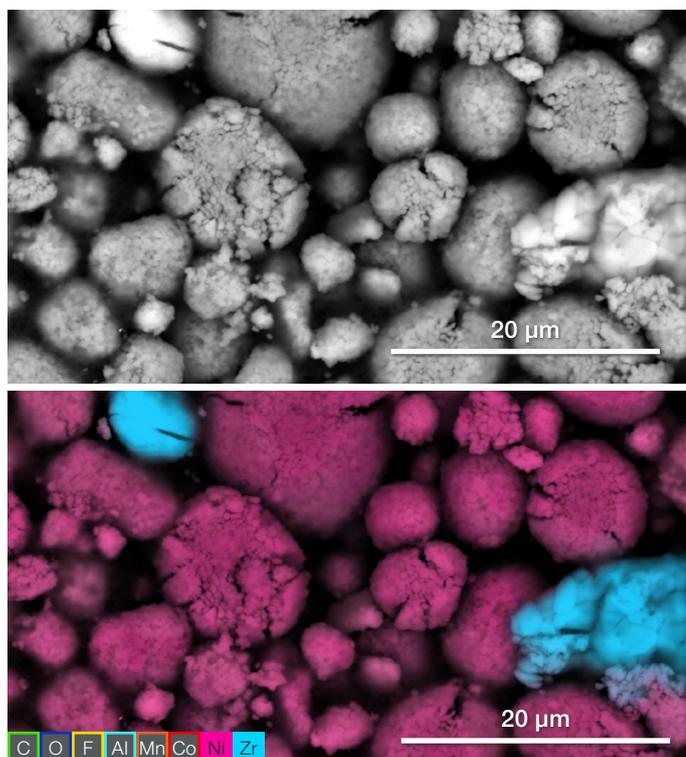
Flexible detector configuration

Optional detection technology includes a robust and easy-to-use RGB cathodoluminescence detector that provides more information than panchromatic CL systems, making it particularly useful for mineral identification. Optional EBSD provides full structural information and can be operated simultaneously with the TrueSight EDS detector for a complete analytical picture.

Easy maintenance

Source exchange in the Axia ChemiSEM can be easily completed by users of any experience level in just a few minutes thanks to the automated alignment functions. Every aspect of the Axia ChemiSEM has been optimized to achieve maximum uptime and ease of service. And to ensure that the Axia ChemiSEM's system software remains up to date, the MyMicroscope application offers automatic updates.
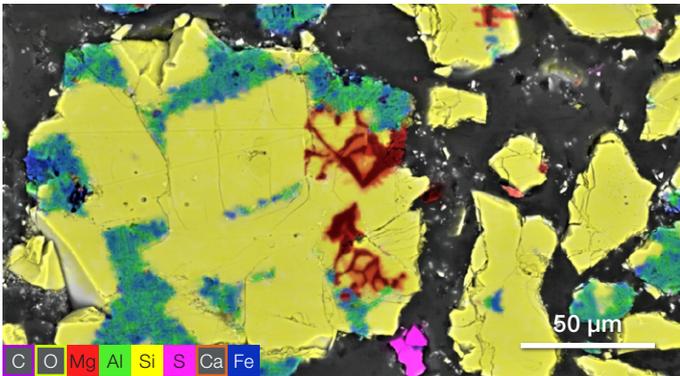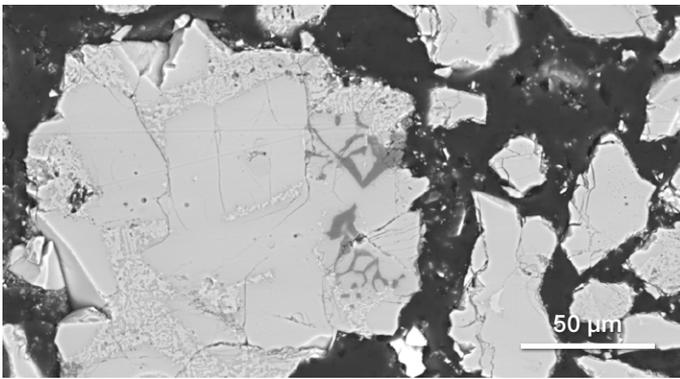

Technical highlights

Electron optics

- High-performance thermal emission SEM column with tetrode source emission geometry

- Stable electronically aligned column with fixed-objective aperture for ease of operation

- Fully automatic filament exchange alignment procedure

- 45° objective lens geometry

- Through-the-lens differential pumping reduces beam skirting for the most accurate analysis and highest resolution at low beam energies in low vacuum

Electron beam resolution

- High-vacuum imaging

    - 3.0 nm @ 30 kV (SE)

    - 8.0 nm @ 3 kV (SE)

- High-vacuum imaging with beam deceleration

    - 7.0 nm @ 3 kV (BD mode* + BSED)

- Low-vacuum imaging*

    - 3.0 nm @ 30 kV (SE)

    - 4.0 nm @ 30 kV (BSE)

    - 10 nm @ 3 kV (SE)

ChemiSEM image of an NCM battery electrode. The contribution of the EDS information given by ChemiSEM Technology highlights the presence of Zr contaminants in the matrix of the electrode. This would have otherwise gone unnoticed, as the compositional contrast in the CBS image in this case is insufficient to see the presence of unknown elements.

ChemiSEM image of a cement sample, acquired in low vacuum with a pressure of 150 Pa. The image shows the distribution of different phases such as periclase (MgO) in red and ferrite in green/blue ($Ca_2(Al,Fe)_2O_5$). The yellow phase is a mixture of both Ca and Si, so it is either alite (Ca_3SiO_5) or belite (Ca_2SiO_4). The image also shows the presence of an unexpected contaminant (in pink), which is sulfur-rich.

Electron beam parameter space

- Beam current range: up to 2 µA, continuously adjustable

- Accelerating voltage range: 200 V – 30 kV

- Magnification: 5 to 1,000,000× (Polaroid)

Chamber

- Inner width: 280 mm

- Analytical working distance: 10 mm

- Ports: an Axia ChemiSEM configured with BSED and EDS offers five available ports

- EDS take-off angle: 35°

- Two opposing EDS detectors possible

- Coplanar EDS/EBSD orthogonal to the tilt axis of the stage

Detectors

Detects up to four signals simultaneously from any combination of the available detectors or detector segments:

- ETD: Everhart-Thornley SE detector

- Retractable under-the-lens backscatter detector

- TrueSight X EDS detector. Solid angle 13 mSr, resolution 129 eV, area 25 mm2. Optional upgrade to TrueSight LX - 38 mSr, 132 eV, 70 mm2

- Low-vacuum SE detector (LVD), standard on LoVac model

- IR camera for viewing sample in chamber

- Thermo Scientific Nav-Cam™ Camera: color optical camera for sample navigation

- Photon Cathodoluminescence Detector* for UI-integrated real color CL imaging

- Quasor II EBSD detector* with Thermo Scientific Pathfinder™ X-ray Microanalysis Software

- Current measurement

- Third party detectors possible

Vacuum system

- TMP, 1 × PVP

- Patented through-the-lens differential pumping

- Evacuation time: ≤2 minutes to high vacuum (requires nitrogen venting) and and ≤4.5 minutes to low vacuum*

Sample holders

- Standard multi-sample SEM holder uniquely mounts directly onto the stage, hosts up to 7 standard stubs (ø 12 mm), and does not require tools to mount a sample

- Single stub holder

Stage

- Type: 5-axis motorized

- XY: 120×120 mm

- Motorized Z: 55 mm

- Rotation: n×360°

- Tilt: -15° / +90°

- Max. sample height:

  - Clearance 72 mm to analytical working distance (10 mm), no sample holder

  - Clearance 128 mm to analytical working distance (10 mm) with ZTR axes removed

- Max. sample weight:

  - Up to 500 g XYZTR

  - Up to 2 kg XYZR

  - Up to 10 kg with ZTR axes removed

- Max. sample size:

  - 138 mm diameter with full XY moves, rotation, no tilt (larger samples possible with limited stage travel or rotation)

System control

- 64-bit GUI with Windows 10, keyboard, optical mouse

- 24-inch LCD display, WUXGA 1920×1200 (second monitor optional)

- Customizable graphical user interface, with up to four simultaneously active views

- Navigation montage

- Undo / Redo functionality

- User Guidance for basic operations / applications

Image processor

- Dwell time range from 50 ns to 25 ms/pixel

- Up to 6144×4096 pixels

- File type: TIFF (8-, 16-, 24-bit), JPEG or BMP

- Single-frame or 4-view image display

- SmartSCAN (256-frame average or integration, line integration and averaging, interlaced scanning)

- DCFI (Drift Compensated Frame Integration)*

Accessories*

- Beam deceleration with stage bias -4,000 V

- Manual user interface

- Joystick

- Analysis: EDS, EBSD, CL, Raman

- Specimen current meter

- Specimen holder kit

- Acoustic enclosure for vacuum pump

- 7- or 52-pin electrical feedthrough

- Oil-free pre-vacuum pumping

- SEM start-up kit

- Software controlled 1,100°C CleanHeater stage

- Electrical probing / multi-probing stations

Software*

- Maps Software for automatic large area acquisition using tiling and stitching; correlative work

- AutoScript 4 Software—a Python-based

- Application programming interface

- TopoMaps for image colorization, image analysis, and 3D surface reconstruction

- Remote control software

- ChemiView software for full EDS data processing

Documentation

- Video-guided training

- Online User Guidance

- Operating instructions handbook

- Online help

- Prepared for Thermo Scientific RAPID™ Service (remote diagnostic support)

Warranty and Training

- One-year warranty

- Choice of service maintenance contracts

- Choice of operation / application training contracts

Installation requirements
(Refer to preinstall guide for detailed data)

- Power:

  – Voltage 100–120 V_{AC} or 200–240 V_{AC}

  – Frequency 50 or 60 Hz

  – Consumption: <2.0 kVA for basic microscope

- Environment:

  – Temperature 17–27 °C / 63–81 °F

  – Relative humidity below 70%

  – Stray AC magnetic fields <100 nT asynchronous, <300 nT synchronous for line times, 20 ms (50 Hz mains), or 17 ms (60 Hz mains)

- Minimum door size: 0.8 m wide × 1.63 m high

- Weight: column console 405 kg

- Dry nitrogen recommended for venting

- Acoustics: <68 dBC (site survey required, as acoustics spectrum relevant)

- Active vibration isolation table*

Consumables (partial list)

- Pre-centered cathodes

- Tungsten filaments

- Apertures

- Rotary pump oil

* Optional

Learn more at **thermofisher.com/Axia-ChemiSEM**

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