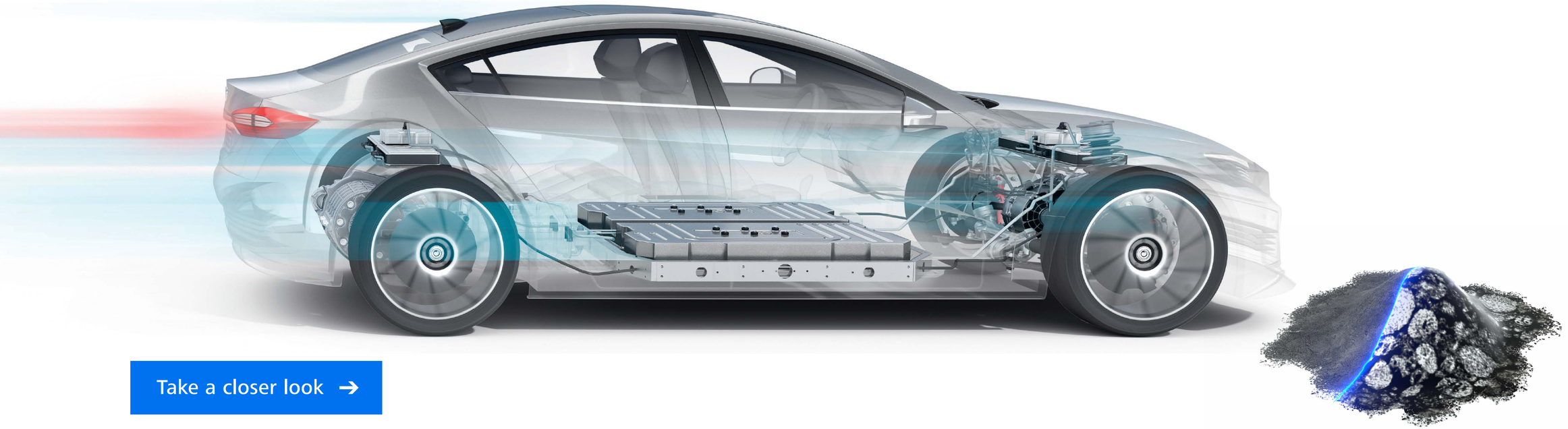
ZEISS eMobility Solutions

Battery Material Microstructure Analysis

by SEM & EDS

Seeing beyond



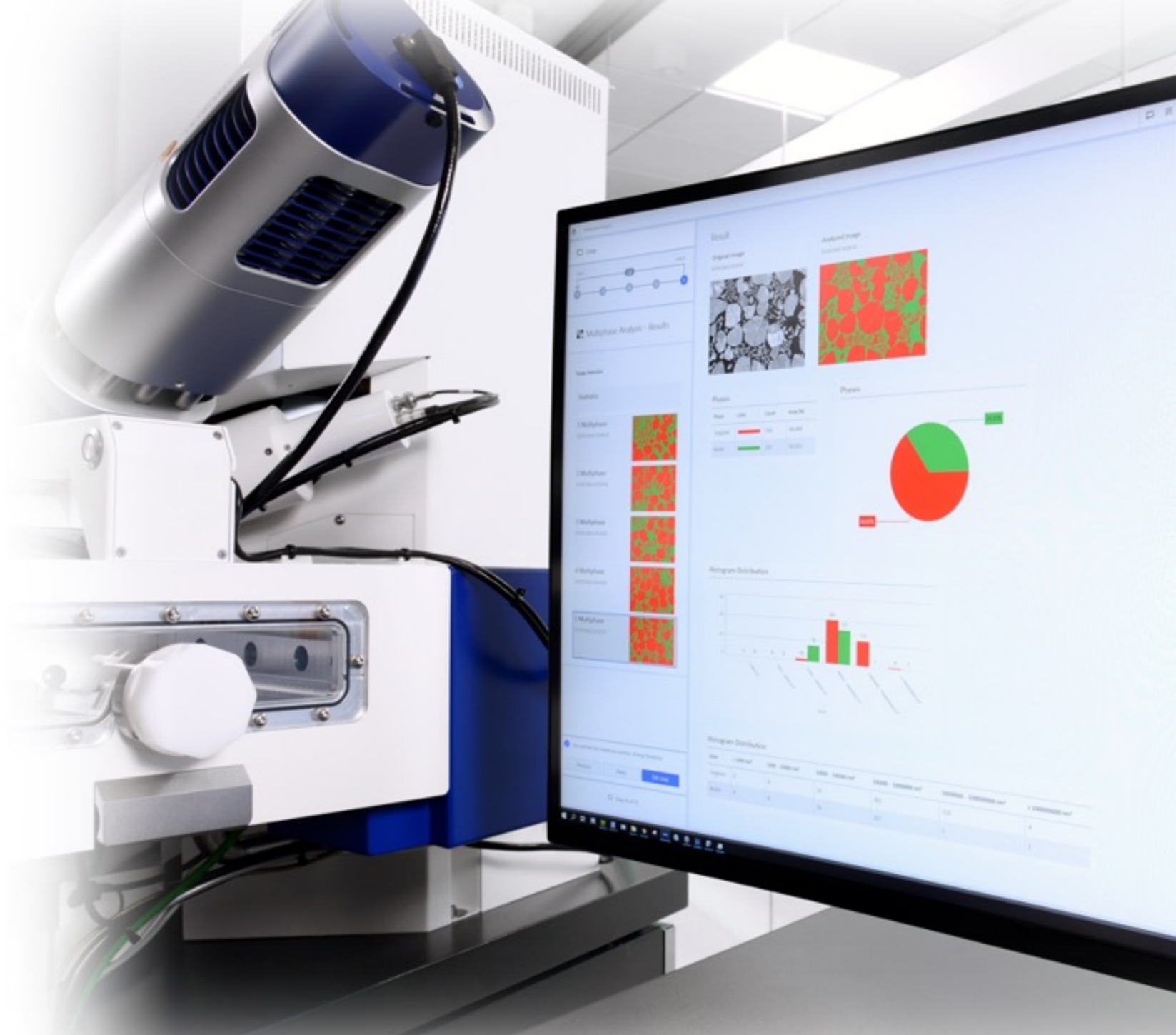
Take a closer look →

High quality imaging
Battery material R&D by SEM & EDS

Power battery is a crucial component of new energy vehicles (NEV), directly impacting the safety, performance, and production costs of the entire vehicle. Comprising primarily of cathode and anode materials, separators, electrolytes, the development direction of batteries primarily revolves around the exploration of cathode and anode materials that offer high specific capacity, superior safety, low cost, and environmental friendliness.

To develop new-generation battery materials, a series of characterizations and analyses must be conducted throughout the research and development (R&D) process. ZEISS provides scanning electron microscopes (SEM) and energy dispersive spectrometer (EDS) as research tools for battery microstructure analysis.

> Learn more about the process and applications



Ensuring quality of raw materials
Evaluation with SEM & EDS

The battery production process encompasses material R&D, the electrode manufacturing, cell assembly, and module packaging.
Among these steps, the quality of battery materials, including geometric morphology, particle size distribution, and composition and phase structure of microscopic regions, is directly linked to the overall vehicle performance and safety.
SEM are commonly used for observing material surface morphologies, and EDS can be paired with SEM to conduct qualitative or quantitative analysis of elements present in minute areas. These solutions provide crucial microscopic information for the design, optimization, and performance enhancement of battery materials.

Battery production process →

R&D and production process evolution of NEV battery

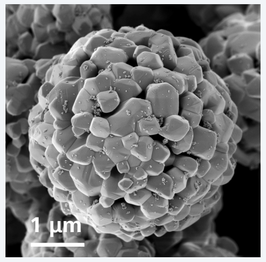
Step 1
New material demand

It is necessary to develop new battery materials with enhanced electrochemical performance, higher safety, and cost-effectiveness to fulfill societal demands.

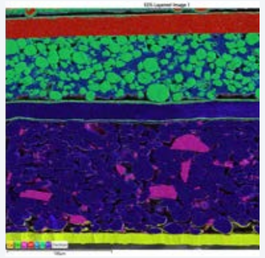
Step 2
Material synthetic methods

Step 3
Single material evaluation

SEM & EDS



Surface morphological characterization
1. High-resolution imaging
2. Low-kV imaging
3. Surface sensitive samples imaging
4. Magnetic samples imaging



Elemental energy spectrum analysis
1. Element detection and percentage analysis
2. Technical cleanliness analysis

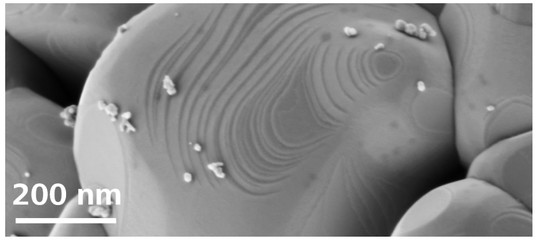
Step 4
Small cell performance

Step 5
NEV cell performance

Step 6
Commercialization

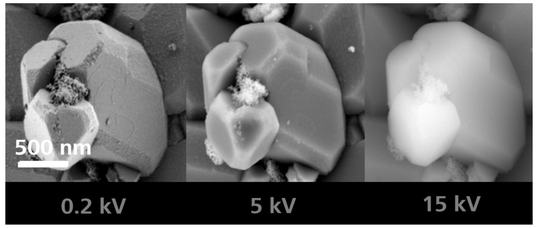
> See more details of the application areas

Application areas of SEM & EDS



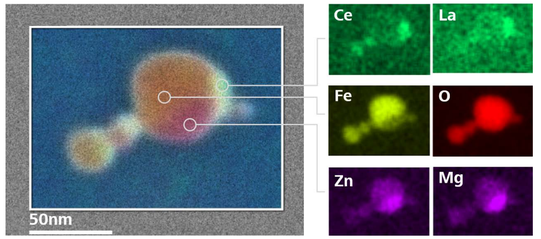
High-resolution imaging

- Observation of material micromorphology
- Material category and structure identification



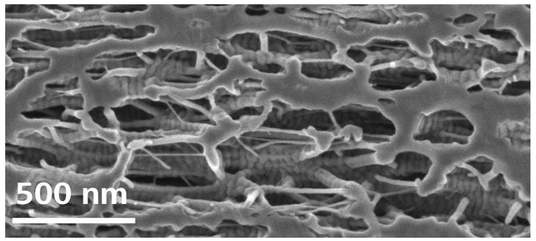
Low-kV imaging

- Extreme surface details obtaining
- Avoidance of material surface charging



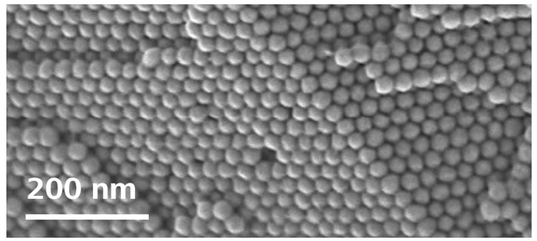
Element detection and percentage analysis

- High resolution EDS analysis on non-conductive samples
- Low vacuum / low kV EDS analysis



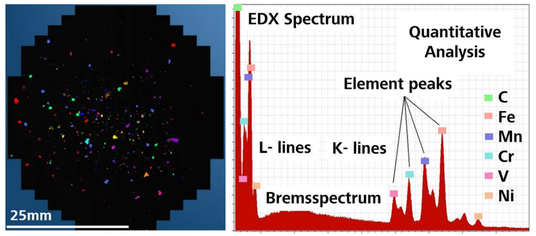
Surface sensitive samples imaging

- Microscopic imaging of high molecular polymers
- Sub-Nanometer imaging of Thin Films



Magnetic samples imaging

- Observation of iron, cobalt, nickel and their metal oxides
- Observed directly without degaussing

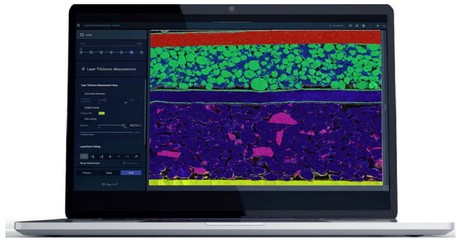


Technical cleanliness analysis

- Particle classification on the basis of elemental composition
- Correlative Automated Particle Analysis (CAPA)

> Have a look into the value proposition

Value proposition of ZEISS solution



Excellent imaging results

- Acquire great imaging results and accurate elemental chemistry information
- Deepen understanding of battery materials

Friendly for both expert and novice users

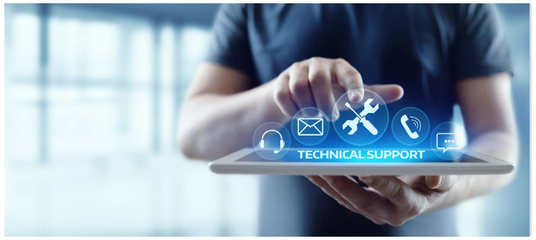
- For expert users: enable full control over the microscope with full access to all functions and parameters available
- For novice users: empower users to generate excellent images, regardless of skill level

Increase efficiency

- Flexible and convenient operation to save time
- Highly intelligent to improve efficiency

Reliable and repeatable data

- Reliable user-independent and reproducible results
- Reach highest quality and fulfill industry standards like VDA 19.1



Cost saving

- Easy to use: drastically reduce training costs
- Long service life and high durability

Speed up workflow

- Achieve high throughput for simple automated imaging workflows
- Satisfy sub-nanometer imaging, analytics and sample flexibility

> See more details of recommended portfolio

Recommended portfolio

Best qualified SEM to support industrial quality
ZEISS EVO

Resolution	3 nm @ 30 kV - SE 8 nm @ 3 kV - SE
Magnification	5x to 1,000,000x
Probe current	0.5 pA to 5 µA
Acceleration voltage	0.2 - 30 kV, step: 10V

Benefits:

- High cost performance
- High probe current stability
- High resolution storage: 32000 × 24000 pixels
- Correlation microscope: SEM & LM

> Explore ZEISS EVO

Field emission SEM technology with an excellent user experience
ZEISS Sigma

Resolution	0.7 nm @ 15 kV* 1.2 nm @ 1 kV*
Magnification	10x to 1,000,000x
Probe current stability	0.2%/h
Acceleration voltage	0.02 - 30 kV, step: 10V

* The highest indicator in the series

Benefits:

- High probe current stability
- High resolution storage: 32000 × 24000 pixels
- Excellent low-kV imaging
- Correlation microscope: SEM & LM

> Explore ZEISS Sigma

Field emission SEM for the highest demands in imaging and analytics
ZEISS GeminiSEM

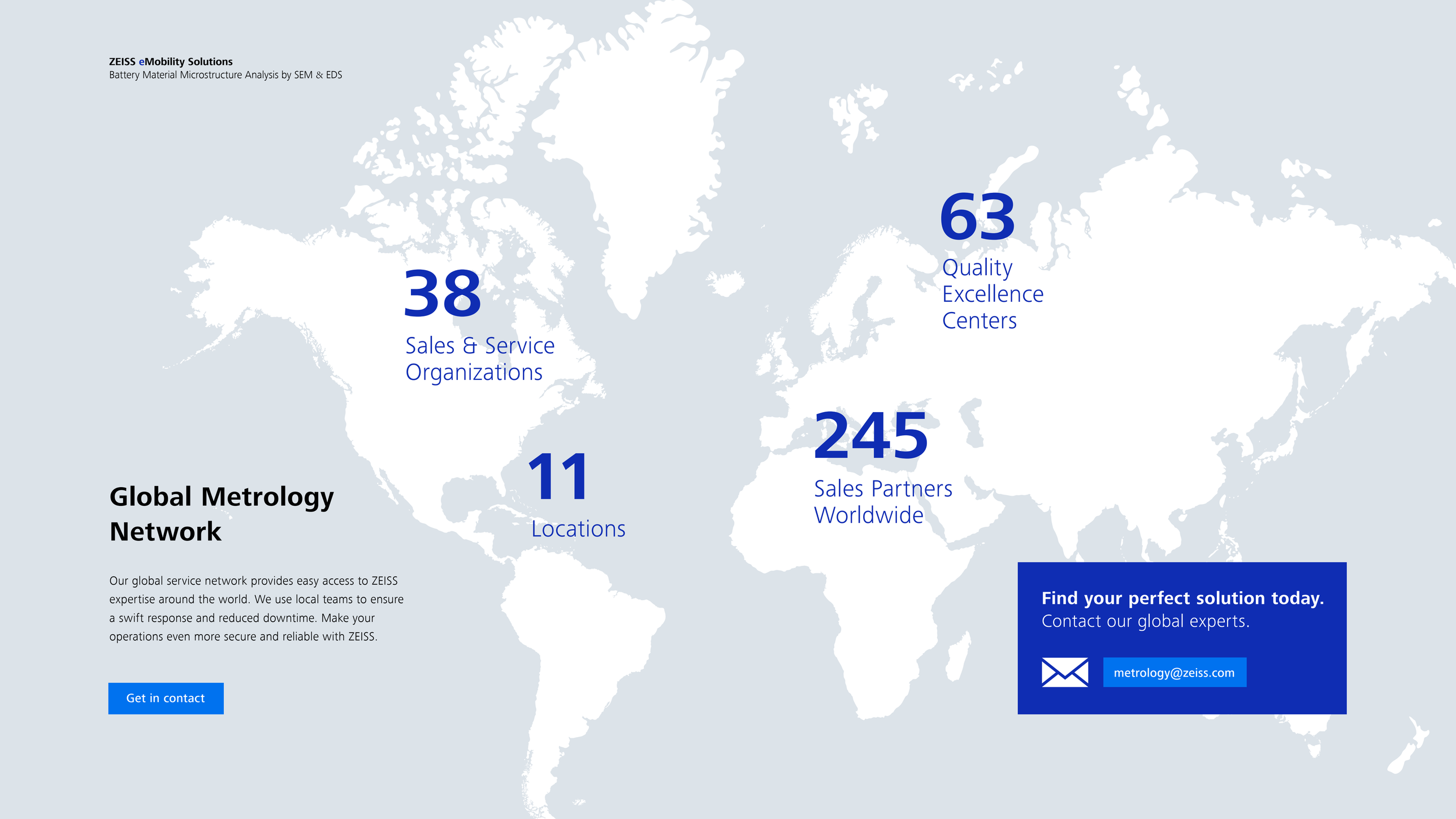
Resolution	0.5 nm @ 15 kV* 0.8 nm @ 1 kV*
Magnification	1x to 2,000,000x
Probe current stability	0.2%/h
Acceleration voltage	0.02 - 30 kV, step: 10V

* The highest indicator in the series

Benefits:

- High probe current stability
- High resolution storage: 32000 × 24000 pixels
- Excellent low-kV imaging
- Correlation microscope: SEM & LM

> Explore ZEISS GeminiSEM



38
Sales & Service Organizations

11
Locations

63
Quality Excellence Centers

245
Sales Partners Worldwide

Global Metrology Network

Our global service network provides easy access to ZEISS expertise around the world. We use local teams to ensure a swift response and reduced downtime. Make your operations even more secure and reliable with ZEISS.

Get in contact

Find your perfect solution today.
Contact our global experts.

metrology@zeiss.com