NenoVision

Application note

LiteScope´s unique applications

LiteScope's unique applications represent measurements, where the simultaneous utilization of an SEM and an AFM is either completely indispensable or vastly superior to the use of separate conventional instruments.

LiteScope – AFM in SEM.

LiteScope™ is a unique Atomic Force Microscope designed for integration into Scanning Electron Microscopes. The connection of an AFM and an SEM enables merging the strengths of both techniques. Additionally, our proprietary Correlative Probe and Electron Microscopy technology (CPEM) allows for nanometer precise in-time AFM and SEM data correlation.

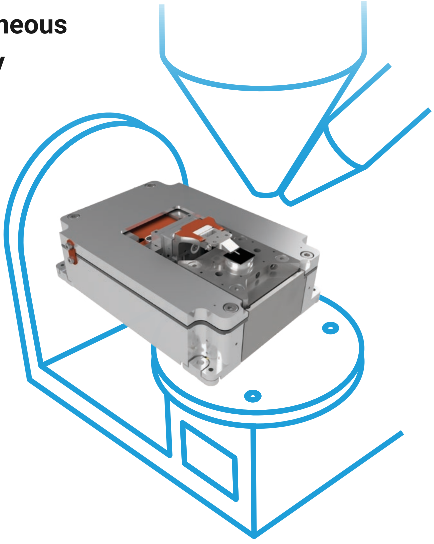
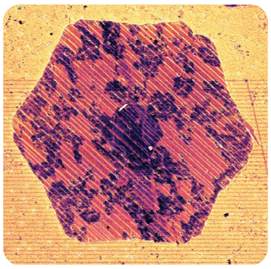


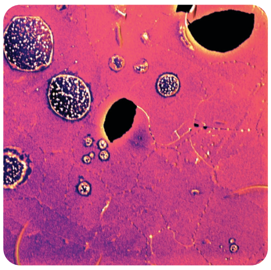
Figure 1: Scheme of LiteScope 2.0 installed inside an SEM.

LiteScope Application areas



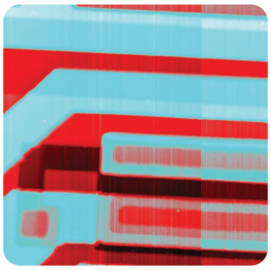
Material Science

- 1D / 2D materials
- Steel & metal alloys
- Batteries
- Ceramics
- Polymers & Composites



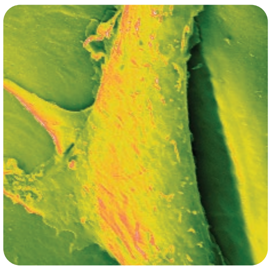
Nanostructures

- Modified surfaces FIB/GIS
- Quantum dots
- Nanostructured films
- Nano-patterning
- Nanowires



Semiconductors

- Integrated circuits
- Solar cells
- MEMS / NEMS
- Failure analyses
- Dopant visualization
- Current leakage localization



Life Science

- Cell biology
- Marine biology
- Protein technology

Complex sample analysis

The AFM-in-SEM approach allows for complex, yet time-efficient sample analysis that combines the capabilities of both techniques. The unique method of multidimensional correlative imaging (CPEM) enables simultaneous acquisition of the data from the SEM and AFM, and their precise correlation into 3D images.

In-situ conditions - complete sample analysis inside the SEM eliminates the unwanted influence of external conditions

Both AFM and SEM measurements are done at the same time, in the same place and under the same conditions preventing sample contamination, transfer or degradation of sensitive samples.

Precise localization of the region of interest

Extremely precise and time saving approach using SEM to localize and navigate the AFM to the region of interest.

Complex analysis of 2D materials

Analysis of molybdenum carbide

LiteScope in connection with SEM allows for complex, yet time-efficient correlative imaging of an identical spot on the sample. The presented analysis of the Mo2C sample includes topography, EDX, material contrast and mechanical properties

- CPEM: precise correlation of chosen AFM and SEM data
- SEM-EDX: fast nanostructure localization and elemental analysis
- AFM: topography, conductivity, mechanical properties

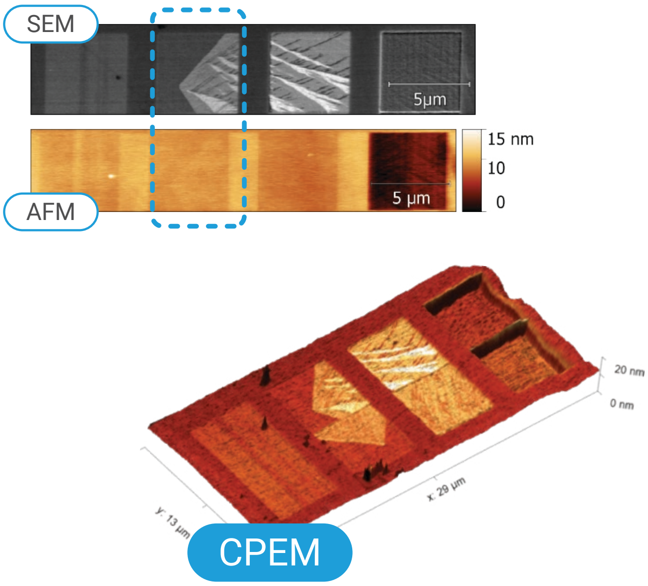


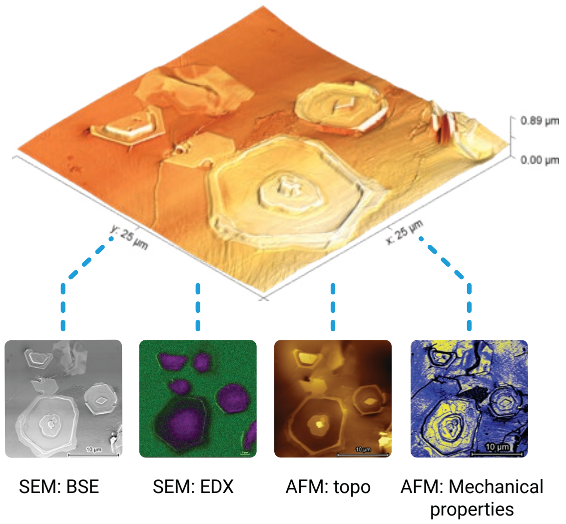
Figure 4: SEM image, AFM image, and 3D CPEM view of FIB milled squares using increasing ion dose. The interface of the FIB induced paramagnetic to ferromagnetic transformation is highlighted.

Fast & easy localization of region of interest

WSe_2 flakes on silicon nanopillars

A certain shape of a WSe_2 flake monolayer over nanopillars creates a single-photon emitter.

- Fast ROI localization by SEM
- Difficult sample for AFM - combination of 1D and 2D materials
- CPEM: correlation of topography with monolayer resolution (AFM) and material contrast (SEM)



SEM: BSE
SEM: EDX
AFM: topo
AFM: Mechanical properties

Figure 3: Correlative analysis of the same spot of the Mo2C sample included AFM topography and mechanical properties, and SEM material contrast and elemental analysis.

In-situ analysis of sensitive samples

Magnetic nanopatterning

In-situ AFM in SEM was necessary to selectively change (Focused Ion Beam) and immediately characterize the change of the magnetic properties of a metastable $Fe_{78}Ni_{22}$ thin film.

- In-situ conditions - FIB induced transformation of a sensitive sample had to be characterized by AFM and SEM in in-situ conditions.
- Immediate and precise ROI identification – small structural change at the FIB induced interface had to be analyzed by AFM.

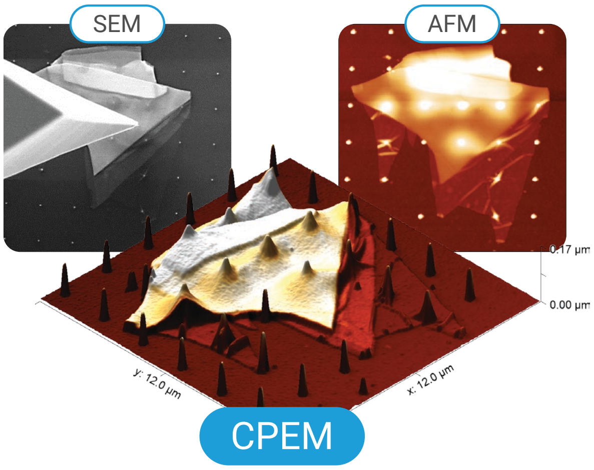


Figure 5: SEM image, AFM image, and 3D CPEM view of WSe_2 flake on Si nanopillars.

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