

Introduction of AFM-in-SEM

Correlative microscopy is an approach which benefits from imaging of the same object by different techniques. Correlation between the data, measured by two or more independent methods, can provide a piece of further information about the sample, which could be too complicated to analyze by those methods separately.

Correlative imaging by atomic force microscopy (AFM) and scanning electron microscopy (SEM) is very challenging due to the differences in coordination systems, spatial resolution, scanning nonlinearities, and other effects, which cannot be simply corrected by post-processing. Novel technique Correlative Probe and Electron Microscopy™ (CPEM) overcomes these problems and enables real correlative imaging.

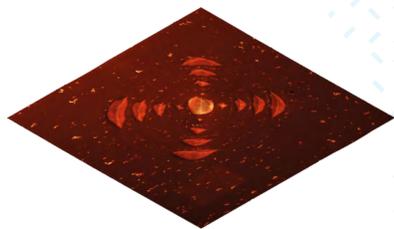


NenoVision LiteScope™ - atomic force microscope designed for the application of CPEM

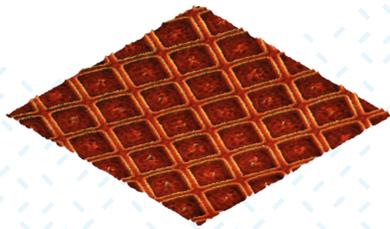
LiteScope™ – Atomic Force Microscope

LiteScope™ is carefully designed for easy integration into various scanning electron microscopes (SEM). Combination of such complementary techniques like AFM and SEM enables it to take advantage of both commonly used microscopy techniques. The complex sample analysis including surface topography, roughness, height/depth profiling or local conductivity can be obtained by LiteScope™ using different replaceable probes.

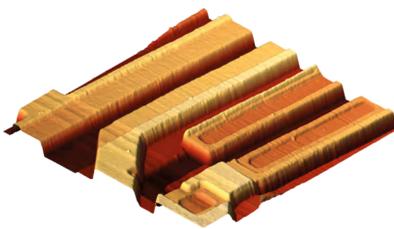
Examples of CPEM analysis



Anisotropic wet etching of silicon



FIB etched structure



Surface of 74LS14 integrated circuit

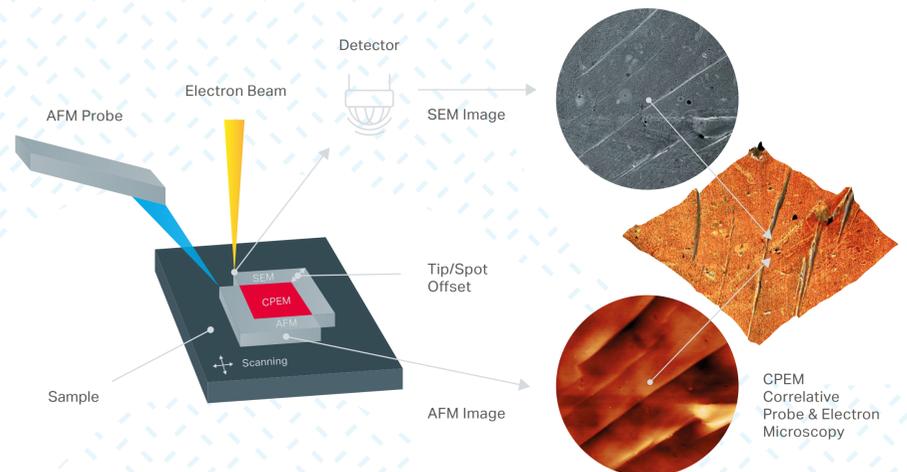


Textured PIN diode solar cell

CPEM – principles

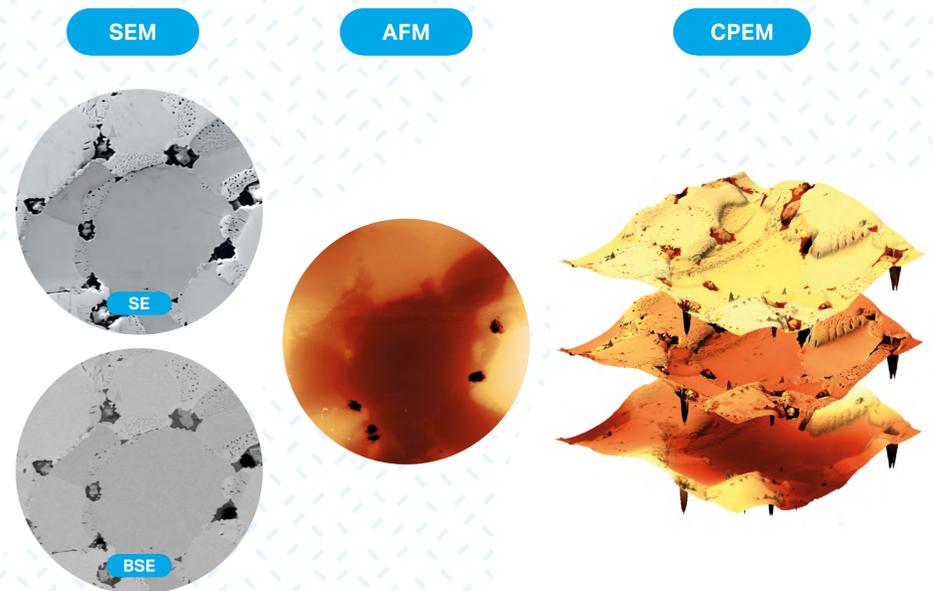
CPEM enables simultaneous surface characterization of a region of interest by SEM and AFM at the same time and in the same coordinate system. The electron beam is focused close to the stationary AFM tip. Subsequently, the scanning is provided by the piezo scanner with a mounted sample. Neither the e-beam nor the AFM probe is moving during CPEM image acquisition.

Simultaneous sampling of SEM and AFM signals with known constant offset and identical pixel size ensures that the analysis is performed on the same surface at the same time and can be directly used for correlative imaging.



CPEM principle

True correlative imaging



SEM (SE), SEM (BSE), AFM and CPEM images of W-10Cr-1Hf. CPEM represents 3D topography (bottom layer) followed by 3D with SEM (SE) color mask and SEM (BSE) color mask

CPEM technique can combine and directly correlate several different signals from AFM and SEM (topography, cAFM, SE, BSE, CL, EBIC, etc.) to obtain comprehensive sample analysis.