Invitation

to the 34th Scientific Seminar of the Dresden Fraunhofer Cluster Nanoanalysis

We are cordially inviting you to the following scientific presentations:

"The novel approach to correlative microscopy of AFM-in-SEM using CPEM technology"

Dr. Jan Neuman,
CEO and Founder of NenoVision s.r.o., Brno, Czech Republic

"From AFM force spectroscopy to force sensing beads"

Prof. Dr. Andreas Fery
Institute for Physical Chemistry and Polymer Physics
and Technical University Dresden, Germany

The seminar is scheduled for
Thursday, 25th June 2020, 15:00 – 17:00
via Microsoft Teams

If you are interested in participating the seminar, please send an email to ehrenfried.zschech@ikts.fraunhofer.de. We will provide the MS Teams link.

Prof. Dr. Ehrenfried Zschech
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Dr. Birgit Jost
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“The novel approach to correlative microscopy of AFM-in-SEM using CPEM technology”

Dr. Jan Neuman,
CEO and Founder of NenoVision s.r.o., Brno, Czech Republic

Scanning electron microscopy (SEM) and atomic force microscopy (AFM) are two of the most used, complementary techniques for surface analysis at the nanoscale. Thus, combining them by integrating a compact AFM into SEM brings novel possibilities for true correlative microscopy and advanced multi-modal sample characterization that would be often unfeasible using each imaging modality separately.

LiteScope™ (Figure 1a) represents a compact AFM, designed to be integrated into a large variety of SEMs. The strength of the AFM-in-SEM hybrid system lies in combining the AFM modes (3D topography, electrical, mechanical, and magnetic measurements) with SEM capabilities (fast imaging with wide resolution range, chemical analysis, surface modification, etc.). Further benefits include precise AFM tip navigation by SEM and measurement under in-situ conditions, which is essential for sensitive samples. Uniquely, LiteScope design enables simultaneous acquisition and correlation of AFM and SEM data by a technique called Correlative Probe and Electron Microscopy (CPEM).

CPEM functionates in a way that the electron beam and AFM probe keep a constant offset and remain static during the image acquisition (Figure 1b). The scanning movement is conducted by a piezo scanner that carries the sample. This ensures simultaneous data collection in the same coordinate system and with identical pixel size. The resulting 3D CPEM view can combine multiple channels, both from AFM and SEM (Figure 1c).

Some of the above-mentioned advantages are demonstrated in Figure 2, showing structural analysis of multilayered WSe_2 flakes on Si nanopillars, where a certain shape of the WSe_2 monolayer over the nanopillars creates a single-photon emitter. A monolayer of WSe_2 is barely visible in the SEM image, but it’s clearly distinguishable on the AFM topography. Also, the AFM-in-SEM system enabled to quickly localize the structure of interest and the 3D CPEM view allowed unmistakable data interpretation.

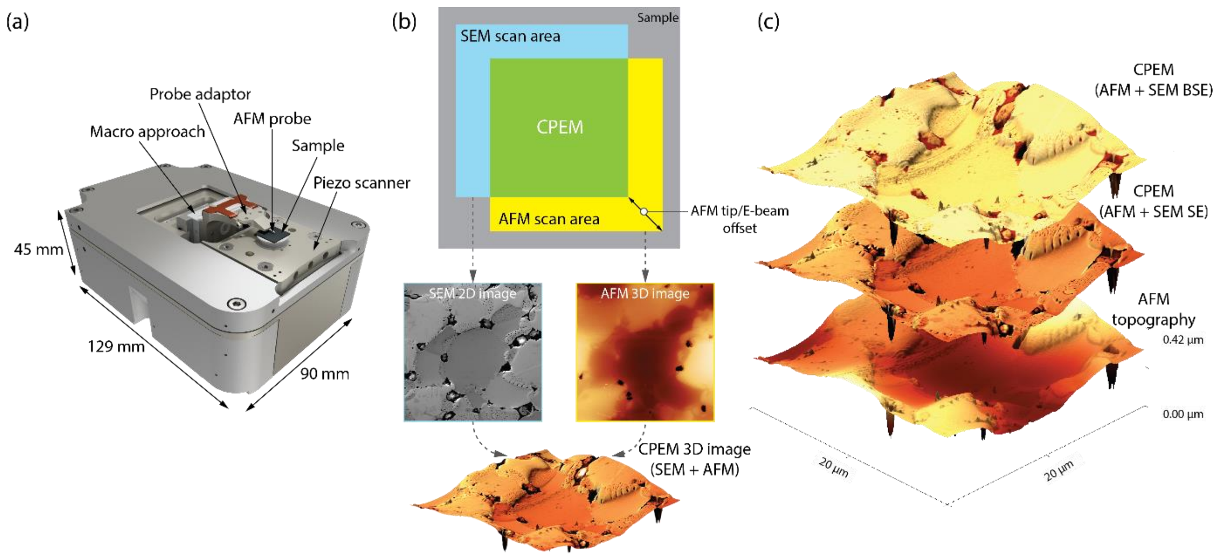

Figure 1: (a) AFM LiteScope, (b) CPEM principle and (c) 3D CPEM view of tungsten alloy consisting of multiple channels (SEM SE and BSE).

“From AFM force spectroscopy to force sensing beads”

Prof. Dr. Andreas Fery
Institute for Physical Chemistry and Polymer Physics
and Technical University Dresden, Germany

Force measurements on the nano- and microscale are essential for materials science and Atomic force microscopy (AFM) provides excellent means for quantifying mechanical properties and surface interactions in force spectroscopy experiments.

The Fery group has specialized on the so called colloidal probe AFM (CP-AFM) technique. Here, a spherical particle is used instead of the classical sharp AFM tip in order to provide a well-defined and known contact geometry. Thus, the measured forced can be translated into interaction energies and/or mechanical materials parameters. The technique is especially useful for soft matter such as polymeric coatings, hydrogels, as well as a broad range of deformable particles including microcapsules. For more complex deformation scenarios, the AFM can be combined *in situ* with optical microscopy techniques such as confocal laser-scanning fluorescence microscopy (CLSM) which allows correlating forces with shape changes.

One recent application of this technique lies in the development of mechano-sensitive coatings (fig. (b)) and particles (fig. (c)). These systems are designed such, that they react towards deformation with a change in their fluorescence. In this way, deformations can be detected optically, once the system is calibrated via CP-AFM. Thus, stresses can be determined in situations which are not accessible to conventional force probes. Typical examples are forces in biomimetic adhesion or forces inside cell-cultures.

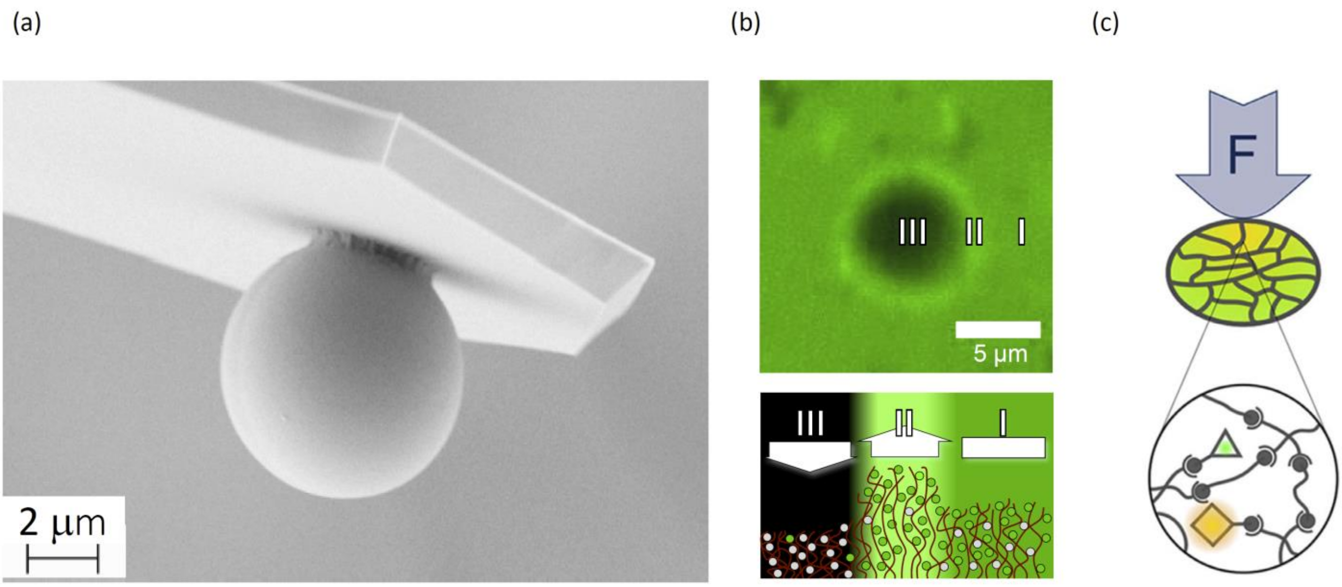

Figure 1: (a) Colloidal probe AFM (b) Mechanoresponsive surface showing fluorescence quenching upon compression and fluorescence increase upon stretching (c) design of 3D sensing particles using Förster Resonance Energy Transfer mechanism