DEUTSCHE GESELLSCHAFT FÜR ELEKTRONENMIKROSKOPIE

Program

4th DGE Young Scientist Symposium

Thursday, May 19th, 2022 from 14:00 to 16:00

Online using Zoom:

https://zoom.us/j/97328791182?pwd=QUVWRUxmeUZPVjV1NWlDcVdFNDlsQT09
Meeting ID: 973 2879 1182   Passcode: 866645

14:00 Dr. Vanessa Flegler, Universität Würzburg

Application of Electron Cryomicroscopy for Structural and Functional Studies on the Mechanosensitive Channels of Small Conductance

14:40 Dr. Tolga Wagner, TU Berlin

Interference Gating - A New Way for Time-Resolved TEM

15:20 Dr. Lilian Vogl, EMPA Thun

Functional Nanowires studied with Correlative in situ Microscopy

For abstracts please see next page.

Invited by the Board of the
German Society for Electron Microscopy DGE

Abstract of talk presented by Dr. Vanessa Flegler:

Bacteria are constantly exposed to threats imposed by their environment, one of which is rapid changes in osmolarity. A hypoosmotic downshock would ultimately lead to cell death due to the increased pressure within the cell, but mechanosensitive ion channels acting as emergency pressure valves sense the resulting elevated membrane tension levels and gate as a response, restoring the osmotic balance. Apart from the well-studied mechanosensitive channel of small conductance (MscS), there are further – larger – paralogues, for which structural and functional information is rare or non-existent. We combined membrane protein purification- and reconstitution techniques and electron cryomicroscopy to obtain closed and sub-conducting structures of the medium-sized paralogue YnaI and highlight peculiarities in its gating mechanism like flexible pore helices and bound lipid molecules. Based on studies on the small paralogue, MscS, we further identified coordinated lipids as structural determinants for gating and closing, and we proposed an updated gating model putting these lipid molecules in the centre of attention.

Abstract of talk presented by Dr. Tolga Wagner:

The TEM, with its numerous analytical and imaging methods, has evolved over its 90 years of existence into a powerful measurement tool for quantitative analysis of the smallest structures down to atomic spatial resolution. Off-axis electron holography deepens this insight even further by providing access to amplitudes and phases of reconstructed electron waves. Especially, the reconstructed phases contain spatially resolved information about projected electromagnetic potentials of investigated specimens. This makes electron holography (EH) an excellent tool for the investigation of electric potential distributions in semiconductor nanodevices, particularly when they are operated during investigations using special in situ specimen holders. Since existing methods for the realization of time-resolved measurements in a TEM have proven to be disadvantageous for EH, such investigations have so far been limited to measurements of static states of the devices. Time-resolved electron holographic investigations of their dynamic switching processes have not been performed so far.

In this talk, the theoretical development and technical realization of a novel method for time-resolved electron holography, called interference gating, is presented. It is based on intentional time-dependent disturbances of interferometric measurements, by which the interference pattern can be switched on and off during the acquisition, similar to a shutter mechanism. By this, the time resolution of any TEM can be increased from the sub-second range to a few nanoseconds. The talk also contains, as a first application of the developed method, spatially and temporally resolved electron holographic investigations of the switching behavior of a prepared silicon general purpose diode.

Abstract of talk presented by Dr. Lilian Vogl:

The precise characterization of individual nanowires is crucial for further upscaling procedures and device integration. For example, the performance of flexible electrodes, consisting of a percolated nanowire network, is basically given by the mechanical and electrical properties of the single nanowire. In this talk, the functional properties of different nanowires have been analyzed by correlative *in situ* electron and light microscopy. The combination of light and electron microscopy enables a scale bridging analysis and offers the opportunity to characterize the behaviour under application-related conditions and without any electron beam induced effects. The electrical properties are characterised via direct four-point probing inside the electron microscope. By comparing specific MoO_2 with silver nanowires, the difference regarding the contact resistance at nanowire junctions is revealed. Next to the electrical properties the mechanical behaviour of nanowires in different load settings has been examined (bending/tensile testing). Non-destructive resonance measurements are used to determine the vibrational properties. Inside the SEM, the damping behaviour and therefore the sharpness of the nanowire resonance peak mainly depends on the intrinsic properties like the microstructure and the surface quality. By using a compact gas chamber for the light microscopy, the damping effects arising from the surrounding atmosphere are analysed. This correlative approach demonstrates the sensing capability of single nanowires, which path the way towards nanowire based gas and pressure sensing devices.