NANOSCIENCE COLLOQUIUM

Nanofluidic Transmission Electron Microscopy

Professor Kristian S. Mølhave

DTU Nanolab, Technical University of Denmark

Abstract: Liquid Phase Transmission Electron Microscopy (LPTEM) has over the past twenty years opened up for atomic level imaging of processes in liquids allowing unprecedented insights into complex nanoscale processes and materials in liquids. I will illustrate our ongoing work with applications in physics, chemistry, electrochemistry, materials science, softmatter and biotechnology.

To achieve high resolution the encapsulation and liquid layer must be well controlled on the 100 nm scale. Using microfabrication methods we create novel microchip based nanochannel systems and systems clamping two chips with membranes that work as miniature laboratories in the TEM. These provide the needed encapsulation control to obtain insight to complex nanoscale processes.

Combining the systems with electron holographic measurements we are beginning to explore directly mapping electric potentials and charge distributions on the nanoscale[i], which we are also beginning to probe by electrokinetic measurements.

A different liquid system is the nanoscale eutectic droplets at the tip of growing nanowires at high temperature, where we use monocrystalline microcantilever heaters to control nanowire growth processes inside an Environmental TEM (ETEM) capable of providing a precursors gas atmosphere for III-V nanowire growth. By simultaneously applying electric potentials to the cantilevers we can probe how electrical fields influence the droplet and growth[ii], giving new insights to nanowire crystal phase control, surface tension and wetting angle influence.

These microchip-based systems opens up for what could be called ‘Nanofluidic Electron Microscopy’ with new capabilities in a wide range of scientific fields to probe processes in liquids with atomic scale resolution.

[i] Phys. Rev. Lett. 2020, 124 (6), 065502. https://doi.org/10.1103/PhysRevLett.124.065502
[ii] Nature Communications 2016, 7, ncomms12271. https://doi.org/10.1038/ncomms12271

Universität Hamburg
DER FORSCHUNG | DER LEHRE | DER BILDUNG

30.05.2023 1:15 pm | Bd.600
R.301 CHyN

CHyN
Center for Hybrid Nanostructures