CCMX Advanced Course
"Combining Structural & Analytical Investigations of Matter at the Micro-, Nano and Atomic Scale"

5.-8. 11. 2018 ETH Zürich

Station 2 FEI Talos F200X (Location: HCI E529)

CTEM, HRTEM, EDS STEM demo (60 minutes)

Conventional TEM (CTEM) is a main operation mode employed for defect analyses in TEM. It requires deep understanding of the correspondence of the reciprocal and real space information from the same specimen area. High resolution TEM imaging on a non-aberration corrected instrument is affected by delocalization due to aberrations of the electron optic elements. The partial compensation of the delocalization artefacts is performed by controlling defocus during imaging. The scanning of a conical electron probe over a specimen area results in scattering events that are simultaneously registered by a number of detectors. The size and current of the probe determines the STEM resolution. The high energy electron probe causes excitation of the atoms. De-excitation occurs by an emission of X-ray radiation that is detected by an EDS detector. Position- and time- synchronized EDS STEM imaging results in the multidimensional data sets and are the fundament of "analytical TEM".

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Instrument and its main characteristics.

TEM/CTEM (*crystalline material, DT-holder*):
- ✓ Mass-thickness & Diffraction contrast.
- ✓ Electron diffraction pattern. Selected area diffraction (SAD).
- ✓ Bright field / dark field / two-beam condition imaging.
- ✓ Tilting of specimen in a reciprocal space.

HR TEM (*crystalline material, DT-holder*):
- ✓ Optimal conditions for HRTEM imaging.
- ✓ Phase contrast. Spherical aberration & delocalization. Defocus.
- ✓ FFT.

STEM, EDX-STEM (*crystalline material, DT-holder*):
- ✓ Ronchigramm.
- ✓ Probe size, probe current.
- ✓ Collection angle. ADF, HAADF, BF STEM.
- ✓ Contamination artefacts.
- ✓ Geometry and optimal conditional of EDS STEM study.
- ✓ EDX spectrum. Characteristics, energy resolution, artefacts.
- ✓ Spectrum imaging SI.