

**CCMX Advanced Course**  
**“Combining Structural & Analytical Investigations of Matter at the Micro-, Nano  
and Atomic Scale”**  
**5.-8. 11. 2018 ETH Zürich**

Station 7

JEOL Grand ARM

(Location: HPM A 66)

**TEM *in situ* heating and EELS demo (60 minutes)**

High-energy electrons that are transmitted through a thin specimen do not only carry information about the structural arrangement of atoms. By measuring their remaining kinetic energy, we can abstract first-hand information about inelastic processes and energy transfer between the beam electron and electrons in the sample. This energy-loss, measured by electron energy-loss spectroscopy (EELS), is characteristic for the type of interaction and provides detailed information about the local composition and electronic structure of a sample. The high sensitivity of the fine-structure of ionization edges to changes in the geometric and electronic structure will be demonstrated by recording electron beam and temperature induced changes in vanadium oxides.

**Dr. Marc Willinger**

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**Introduction:**

- ✓ Description of instrument and EELS Spectrometer
- ✓ Path of the electron from tip to detector
- ✓ Relation between inelastic interaction and electronic structure

**Experiment:**

- ✓ Recording of EELS spectra (low- and core-loss)
- ✓ Electron beam induced reduction of sample
- ✓ Monitoring oxidation state with EELS
- ✓ Heating of sample
- ✓ Measurement of heat induced changes in the electronic structure