

## **Transmission electron microscopy in materials science**

Year 2, semester II, 10 h exam

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The course is divided to several parts, i.e. classical transmission electron microscopy (TEM) techniques, advanced techniques including high resolution and energy filtering, sample preparation. The course will be finish with examples of application of TEM method to advanced materials characterization.

The classical transmission microscopy will cover diffraction and mass-thickness contrast problems. The description of diffraction techniques would include setting microscope for obtaining Selected Area (SA) diffraction, micro-diffraction and Convergent Beam Electron Diffraction (CBED). Next, formation of high resolution images at two beam condition and on axis orientation will be discussed. The part of analytical microscopy will concentrate on EDS systems, i.e. interaction of electron beam with a thin foil, proper condition to acquire EDS spectra, its qualitative and quantitative processing as well as possible artifact. The separate time will be assign to energy filtering techniques including  $\Omega$  and Gatan Image Filtering (GIF). The analytical part will be finished with presentation concerning some special application from that field like Atom Location by Channeling Enhanced Microanalysis (ALCHEMI).

The examples of problem solving with TEM will cover nano-composite CrN/Si<sub>3</sub>N<sub>4</sub> coatings, multilayers of Ni/Al, Ni/Cu and Fr/Cr type as well as bulk Al<sub>xxxx</sub>/Saffil fibers nano-composites. They all were chosen to show a proper way, how to plan such experiments starting from sample preparation stage and finishing on choosing a proper TEM technique.