MSE-609

21Intro Scanning electron microscopy techniques

Maeder Xavier, Michler Johann

Cursus	Sem.	Type
Materials Science and Engineering		Opt.

Language of teaching	English
Credits	1
Session	
Exam	Written
Workload	30h
Hours	**18**
Lecture	15
Exercises	3
Number of positions	**16**

Frequency

Every 2 years

Remark

Next time: November 29-December 11, 2023

Summary

Modern Scanning Electron Microscopes, when combined with Focused Ion Beams (Dual beam FIB-SEM), provide a larger number of multimodal imaging and analysis/characterisation modes at the nano- and micron-scales. The aim of the course is to present the extended analytical possibilities of such device.

Content

The aim of the course is the introduction to the different analytical methods in SEM, FIB and brieflely TEM for nano- and micro-structural and chemical investigations. The fundamental theory behind the different analytical methods with their advantage and limitations will be discussed. Theory and demonstration of the different imaging and characterization techniques will be also done in front of FIB, SEM and TEM in samll groups for targeted teaching.
The following subjects will be presented during the course:

- Introduction to the different analytical techniques in SEM and FIB
- Basics of the scanning electron microscopy and focused ion beam instruments (construction principles, signals, interaction with the sample)
- Advanced imaging mode with SEM and FIB: SE, BSE and ion channeling contrast, STEM, Low tension microscopy
- Advanced microstructure investigation with EBSD and transmission EBSD orientation mapping
- EBSD strain and stress analyses with cross-correlation technique
- Chemical analyses with EDS, WDS and µ-XRF
- Chemical depth profile with TOFSIMS
- Introduction to SEM in-situ technique: in-situ diffraction; micro-mechanics; AFM; in-situ heating
- Brief introduction to TEM: TEM vs SEM for imaging and diffraction
- Possibility of measurement of real sample with the participants

Note

This course is open to participants with a basic background in materials science, mechanical engineering, chemical engineering, micro-technology or physics, from both industry and academia.

Keywords

Scanning Electron Microscopy, Focuss Ion Beam, Transmission Electron Microscopy, microanalysis, multimodal imaging, analytical methods, chemical analysis

Learning Prerequisites

Required courses

None

Recommended courses

The course is recommended for every student and scientist using analytical FIB-SEM devices for their work.

Teaching methods

Theory through power point presentations and parctical teaching in front of the devices in small groups for a more targeted teaching.

Resources

Websites

- https://www.epfl.ch/research/domains/ccmx/courses-and-events/sem23/