Electron microscopy: advanced methods

Alexander Duncan

Cursus | Sem. | Type
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Ing.-phys | MA2, MA4 | Opt.
Materials Science and Engineering | MA2, MA4 | Opt.
Minor in Imaging | E | Opt.
Physicien | MA2, MA4 | Opt.

Language of teaching: English
Credits: 3
Session: Summer
Semester: Spring
Exam: Oral
Workload: 90h
Weeks: 14
Hours: 3 weekly
Lecture: 2 weekly
Exercises: 1 weekly
Number of positions

Summary
With this course, the student will learn advanced methods in transmission electron microscopy, especially what is the electron optical setup involved in the acquisition, and how to interpret the data. After the course, students will be able to understand and assess TEM encountered in papers.

Content
1. Electron imaging and diffraction contrasts
2. Phase contrast
3. Scanning TEM
4. EDS-, EEL-spectroscopy in TEM.
Exercises and demonstrations concerning these themes.

Learning Prerequisites

Required courses
- Electron microscopy: introduction
- Basic knowledge of Solid state physics, Crystallography, Crystal defects

Learning Outcomes

By the end of the course, the student must be able to:
• Choose the appropriate TEM technique adapted to their problems
• Recognize The TEM techniques used in a publication
• Interpret TEM images
• Present the TEM results

Teaching methods

Seven weeks of the course will be with MOOCS, 7 weeks with conventional format, alternating over the semester. The weeks with MOOCS format, there will be time reserved at the microscope(s) to discuss and practice on the TEM the content of the lecture, as well as to answer student's questions.

Expected student activities

Follow the MOOCS *before* attending the TEM session for the 7 weeks on MOOCS format.

Assessment methods
Project based evaluation with one individual report + oral evaluation during the exam period. The written report has to be submitted at last, Friday of the second week after the end of the teachings. Each student will be individually interviewed based on this report during the exam session. The grade will be 50% written report 50% oral exam.

Resources

Bibliography

*Transmission Electron Microscopy*
A Textbook for Materials Science
*Williams*, David B., *Carter*, C. Barry

Ressources en bibliothèque

- Egerton. Electron energy-loss spectroscopy in the electron microscope

Moodle Link

- [https://go.epfl.ch/MSE-450](https://go.epfl.ch/MSE-450)