

MSE-450

**Electron microscopy: advanced methods**

Alexander Duncan

Cursus	Sem.	Type
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
<b>Hours</b>	<b>3 weekly</b>
Courses	2 weekly
Exercises	1 weekly
<b>Number of positions</b>	

**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 semestre. 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>