

**Transmission Electron Microscopy (TEM) Specimen Preparation  
Methods in Materials Science, 3.0 credits**

Transmissionselektronmikroskopi (TEM) Provberedningsmetoder i  
materialvetenskap, 3.0 hp

Third-cycle education course

6FIFM38

Department of Physics, Chemistry and Biology

Valid from: Second half-year 2024

**Approved by**

**Approved**

**Registration number**

## Entry requirements

Entry requirement for studies on third-cycle education courses

- second-cycle degree,
- 240 credits in required courses, including at least 60 second-cycle credits,  
or
- acquisition of equivalent knowledge in some other manner

## Learning outcomes

After successful completion of the course, participants will have proficiency to:

- choose and implement the most appropriate TEM specimen preparation protocols for a given sample with regards to the type of analysis needed.
- demonstrate the practical skills in operation of TEM specimen preparation equipment in efficient way.
- be aware of artefact induced by the preparation.
- work safely and handle waste properly in sample preparation rooms.

## Contents

TEM is a powerful microscopy technique enabling material investigations on the atomic level. However, TEM investigations require ultra-thin specimens in order for electrons to be transmitted through with number of additional requires for specimens' quality. This makes TEM specimen preparation of the key importance in order to achieve the optimum TEM characterization results.

The course aims to provide an in-depth understanding of various TEM specimen preparation methods with focus on techniques available at IFM. The emphasis will be placed on efficient hands-on training for different techniques in order to acquire and put required skills in practice.

The course will cover the following topics:

- Basic introduction to TEM and TEM specimen requirements.
- Traditional TEM specimen preparation methods (e.g., cross-sectional 'sandwich', plan-view, powders, tripod, small angle cleavage, etc.).
- Focused Ion Beam (FIB).
- Artifacts induced by TEM specimen preparation.
- Recent advances in TEM specimen preparation.
- Safety during TEM specimen preparation.

## Educational methods

The course consists of lectures (3 x 45 min), seminar (1 x 45 min), laboratory exercises (24 h), self-study of scientific articles, and self-practice in the lab.

## Examination

Compulsory and active participation in all course activities, demonstration of practical skills in the lab and writing lab report.

The participants who pass the course will be:

- awarded with 3 ETC.
- authorized to perform TEM specimen preparation in sample preparation rooms (M215, M216, and M218).
- given the license to book ion milling systems: Merry & Pippin.

Students who fail are offered one re-examination occasion in close connection to the course. After that participation in a coming course examination is offered. The re-examination should be equally comprehensive as the ordinary examination.

## Grading

Two grade scale, older version

## Course literature

Lecture notes, research articles and other hand-outs.

## General information

The course is planned and carried out according to what is stated in this syllabus. Course evaluation, analysis and suggestions for improvement should be fed back to the Research and PhD studies Committee (FUN) by the course coordinator.

If the course is withdrawn or is subject to major changes, examination according to this syllabus is normally offered at three occasions within/in close connection to the two following semesters.