

Physics of materials

Microstructural characterization techniques and introduction to Plasticity

IDENTIFICATION

CODE : SGM-3-S2-CARPLAS
ECTS : 2.0

HOURS

Lectures : 30.0 h
Seminars : 18.0 h
Laboratory : 0.0 h
Project : 0.0 h
Teacher-student
contact : 48.0 h
Personal work : 20.0 h
Total : 68.0 h

ASSESSMENT METHOD

The evaluation will be carried out by a 2h30 written exam, consisting of a part on plasticity and another on microstructural characterisation

TEACHING AIDS

Lecture slides

TEACHING LANGUAGE

French

CONTACT

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AIMS

The objectives at the end of the course are

- Description of the usual material characterization techniques (electron microscopy, X-ray diffraction, X-ray tomography)
- Description of dislocations, their properties
- Introduction to crystal plasticity

This EC SGM-3-CARPLAS falls under the Teaching Unit SGM-3-UE-SDM-S2 Science of Semester 2 materials and contributes to:

School skills in science for engineers:

A1 - Analyze a real or virtual system (or problem) (level 1)

A5 - Processing data (level 2)

A6 - Communicate an analysis or a scientific approach with scenarios adapted to their specificity (level 2)

Specialty-specific school skills:

C1 - Knowing and being able to establish the Structure-Property relationships of Materials (level 1)

C4 - Modeling and predicting the behavior of materials (level 1)

By mobilizing the following skills:

B2 - Work, learn, evolve independently

By allowing the student to work and be assessed on the following knowledge:

- Know the limits and accuracy/resolution of each method
- Know the fundamental principles of the characterization methods covered in the course (SEM, MET, DRX, EBSD, in particular)
- Know the theory of dislocations (definition, interaction, notion of sliding, interactions between dislocations)
- Know the link between macroscopic stresses, such as macroscopic deformation, and forces applied to dislocations

By allowing the student to work and be assessed on the following skills:

- Know how to describe the operating principles of the usual characterization methods in materials
- Know how to interpret the results from microstructural characterization
- Know how to describe the associated microstructures.
- Know how to calculate the forces applied to dislocations and make the link with macroscopic stresses, as well as with macroscopic deformation
- Knowing how to use visualization/processing software for microstructural characterization data such as Aztec, AteX, Carine.

CONTENT

1. Characterisation techniques
Diffraction basics
form factor ...
DRX
MEB - EDX - MET
EBSD + stereo projection
Surface analysis

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2. Introduction to Plasticity
Definition of dislocations
Dislocation interactions
Dislocation sliding
Forces applied to dislocations
Sources of dislocations

BIBLIOGRAPHY

- [1] "Crystallography" - D.SCHWARZENBACH, Presses Polytechniques et Universitaires Romandes 1993
- [2] Microstructural characterization of materials analysis by X-rays and electronics by Claude Esnouf at Presses polytechniques et universitaire romandes
- [3] Materials, Jean Paul Bailon, Jean Marie Dorlot, Presses Internationales Polytechnique, 2000
- [4] Materials Science and Engineering: An Introduction William D. Callister, David G. Rethwisch, Wiley, Jan. 5, 2010

PRE-REQUISITE

Lecture : SGM-3-INTRO

Lecture SGM-3-MICRODD

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