

MSE-441

**Electrochemistry for materials technology**

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<b>Cursus</b>	<b>Sem.</b>	<b>Type</b>
Materials Science and Engineering	MA1, MA3	Opt.

Language of teaching	English
Credits	2
Session	Winter
Semester	Fall
Exam	During the semester
Workload	60h
Weeks	14
<b>Hours</b>	<b>2 weekly</b>
Courses	2 weekly
<b>Number of positions</b>	

**Summary**

This course aims at familiarizing the student with state of the art applications of electrochemistry in materials science and technology as well as material requirements for electrochemical engineering.

**Content**

The course includes a revision of the basic concepts of electrochemistry and of the electrochemical techniques followed by the discussion of relevant applications for surface modifications (galvanic coatings technology, surface structuration, micro/nano fabrication) and energy issues (materials for batteries, fuel cells, hydrogen generation) as well materials aspects in electrochemical engineering (catalytic electrodes, analytical electrochemistry).

**Keywords**

Materials, Electrochemistry, Micro-fabrication, Coatings, Energy generation, Energy conversion

**Learning Prerequisites****Required courses**

Chimie générale, Introduction à la science des matériaux

**Recommended courses**

Métaux et alliages

**Important concepts to start the course**

General chemistry: thermodynamics, kinetics, equilibrium, acid-base and complexation reactions, redox reaction.

Metallurgy: microstructure of metals and alloys, mechanical properties, deformation and rupture.

Physics: electrical circuits, transport phenomena

**Learning Outcomes**

By the end of the course, the student must be able to:

- Use electrochemical concepts and methods for materials science
- Design micro/nano materials via electrochemical processes
- Structure surfaces with tailored properties
- Design appropriate materials for electrochemical systems
- Analyze electrochemical processes and devices

- Manage electrochemical material fabrication
- Describe electrochemical reactions
- Formulate requirements for energy generation and storage materials

### Teaching methods

Ex cathedra with exercises and case studies.

### Expected student activities

Active participation during lectures and in the resolution of exercises, group work in case studies

### Assessment methods

Oral presentation

### Supervision

Office hours	No
Assistants	No
Forum	No
Others	Meetings with teacher upon appointment established by email

### Resources

#### Bibliography

Electrochemistry theory: D. Landolt, Corrosion and Surface Chemistry of Metals, CRC/EPFL Press 2007

#### Ressources en bibliothèque

- [Corrosion and surface chemistry of metals / Landolt](#)

#### Notes/Handbook

Copy of slides available from the website

#### Websites

- <http://tic.epfl.ch>