

MSE-441

Electrochemistry for materials technology

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| Cursus | Sem. | Type |
|-----------------------------------|-------------|-------------|
| Materials Science and Engineering | MA1, MA3 | Opt. |

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

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>