CH-443

Photochemistry II

Moser Jacques-Edouard

Cursus	Sem.	Type
Chimiste	MA2, MA4	Opt.
Photonics		Opt.

Language of teaching	English
Credits	2
Session	Winter, Summer
Semester	Spring
Exam	Oral
Workload	60h
Weeks	14
Hours	**2 weekly**
Courses	2 weekly
Number of positions	

Summary

Following "Photochemistry I", this course introduces the current theoretical models regarding the dynamics of electron transfer. It focuses then on photoredox processes at the surface of solids. Current technological applications, as well as the most recent advances in the field are presented.

Content

1. Dynamics of photoinduced electron transfer. Theoretical models of charge transfer dynamics - Marcus-Hush theory - Fermi golden rule - Semi-classical model - Photoinduced ET - Sensitization of a wide bandgap semiconductor - Detailed treatment of examples of homogeneous and micro-heterogeneous systems
2. Photoelectrochemistry of semiconductors. Contact phenomena at the solid/solid and solid/electrolyte interfaces - Case of finely dispersed semiconductor particles - Ions specific adsorption and surface states - Dynamics of charge carriers in the solid - Spectral sensitization of large bandgap semiconductors
3. Photo-electrochemical conversion of solar energy. Thermodynamic principles and limitations of solar energy conversion efficency - Photogalvanic and photovoltaic cells - Artificial photosynthesis
4. Photocatalysis. Advanced oxidation processes
5. Photographic and xerographic processes. Molecular systems - Photopolymer systems - Electrophotography - Offset printing - Silver photography - Color reproduction
6. Optical data storage. Color theory - High resolution spectroscopy - Optical discs - Holography.

Keywords

Electron transfer dynamics, Marcus theory, Fermi Golden Rule, Photoinduced electron transfer, Semiconductor photoelectrochemistry, Photoelectrochemical conversion of solar energy, Photovoltaics, Photocatalysis, Photography and xerography, Color theory, Optical data storage

Learning Prerequisites

Recommended courses

Quantum chemistry, Molecular spectroscopy, Photochemistry I

Learning Outcomes

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

- Explain the principles of current models of the electron transfer (ET) dynamics
- Discuss the hypotheses made in the various approximations of these theories
- Describe the predictions of classical and semi-classical ET theories
- Represent and explain the constitution of space charge layers at interfaces
- Distinguish the various sources of the limitation of solar energy conversion efficiency

- Represent the principle of photovoltaic and solar fuels generation systems
- Describe the principle of the functionning of photographic and xerographic processes
- Formulate the theory aof colors and explain its application to high resolution spectroscopy
- Propose an example of a photoinduced interfacial electron transfer process and discuss the parameters controlling its rate and efficiency

Teaching methods

Ex cathedra lectures

Assessment methods

Final oral examination

Supervision

Office hours	No
Assistants	No
Forum	No

Resources

Ressources en bibliothèque

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Références suggérées par la bibliothèque

- Fundamentals of photoinduced electron transfer / Kavarnos

Notes/Handbook

Copies of the slides are avallable in pdf format on the course's web site.

Websites

- https://www.epfl.ch/labs/gdp/teaching/pc2/