ChE-603(1)

Interfacial Electrochemistry of Metals and Semiconductors for Energy Conversion and Storage 1- Basic concepts

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Cursus	Sem.	Type
Chemistry and Chemical Engineering		Obl.

Language of teaching	English
Credits	2
Session	
Exam	Multiple
Workload	60h
Hours	**28**
Courses	28
Number of positions	

Frequency

Every year

Remark

Next time: Spring 2020

Summary

The course presents, with emphasis to fundamental physicochemical principles, the basic principles of electrochemical thermodynamics and physical and chemical kinetics as applied to electrochemical conversion systems: batteries, fuel and biofuel cells, electrolysers and photoelectrochemical cells.

Content

1. Summary of the principles of chemical and electrochemical thermodynamics of relevance to electrochemical energetics.
2. Outline of basic concepts of solid-state physics of metals and semiconductors.
3. Thermodynamics of the metal-electrolyte and semiconductor-electrolyte interface on the basis of the electrochemical potential concept. Absolute electrode potential, electrochemical vs. vacuum electrode potential scale for aqueous and nonaqueous electrolyte-based systems.
4. Physical, chemical and electrochemical properties of aqueous, nonaqueous and solid electrolytes. Electrical conductivity and diffusion in electrolytes.
5. Electrochemical kinetics and catalysis at metal and semiconductor electrodes, complex multi-step electrode reactions, adsorption effects.
6. Comparative description of electrochemical and photoelectrochemical systems: primary and secondary batteries, fuel and biofuel (enzymatic and microbial) cells, water electrolysers, electrochemical photovoltaic (electricity-producing) cells. photoelectrosynthetic cells (including e.g. photoelectrochemical water splitting and electrochemical carbon dioxide reduction), photocatalytic cells, including electrochemical fuel and biofuel cells.
7. Application of electrochemical principles to microdispersed photocatalytic systems for energy conversion.

Note

Next session Spring semester 2017 (Mo+Fri)

Assessment methods

Examination:Written examination, homework assignments and one term paper.

Resources

Bibliography

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Ressources en bibliothèque

- Interfacial electrochemistry / Schmicker
- Semiconductor photoelectrochemistry / Pleskov
- Modern electrochemistry / Bockris
- Electrochemical power sources : batteries, fuel cells, and supercapacitors / Bagotsky
- Fundamentals of electrochemistry / Bagotsky
- Electrochemistry at semiconductor and oxidized metal electrodes / Morrison
- Précis de thermodynamique & cinétique électrochimiques / Besson
- Electrochemistry : the basics, with examples / Lefrou
- Fuel cells : problems and solutions / Bagotsky
- Electrochimie : concepts fondamentaux illustrés / Lefrou