CH-341

Physical chemistry of interfaces

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Cursus	Sem.	Type
Chemistry and chemical engineering	BA5	Obl.

Language of teaching	English
Credits	3
Session	Winter
Semester	Fall
Exam	Written
Workload	90h
Weeks	14
Hours	**3 weekly**
Courses	2 weekly
Exercises	1 weekly
Number of positions	

Summary

Acquire an understanding of interfacial phenomena and of micro-heterogeneous colloidal solution systems.

Content

1. Thermodynamics of interfaces
Interfacial tension and surface thermodynamic functions, Laplace pressure, spreading and wetting, contact angle (Young-Dupré equation), capillary ascension, vapor pressure of curved interfaces (Kelvin equation).

2. Colloids/Micelles
Gibbs adsorption equation, solutions of amphiphile molecules (surfactants), hydrophobic effect, micelle formation, critical micellar concentration. Monomolecular Langmuir-Blodgett films.

3. Solid/gas and solid/solution adsorptions
Langmuir, Fowler-Guggenheim and BET isotherms. Adsorption of gases on porous solids, capillary condensation in mesoporous particles.

4. Electrokinetic phenomena
Zeta potential, electro-osmosis and electrophoresis, streaming and sedimentation potentials.

5. Interfaces
Stability of colloids according to the DLVO model. Membrane potential, Goldman's equation.

6. Light scattering by colloids
Rayleigh equation, absorption and scattering cross sections. Determination of the size of particles by light scattering.

7. Characterization of interfaces by microscopy
Introduction to scanning tunnelling microscopy (STM) and atomic force microscopy (AFM).

Keywords

Surface tension.
Micelles.
Adsorption.
Isotherms.
Electrokinetic phenomena.

Learning Prerequisites

Recommended courses

Thermodynamique I & II.
Electrochimie des solutions.

Important concepts to start the course

Thermodynamic functions.
Charged interface, Gouy-Chapman model of the double layer.

Learning Outcomes

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

- Formulate the thermodynamic definition of the surface tension
- Derive the equations related to the surface tension (Young-Laplace, Kelvin, etc.)
- Establish Gibb's adsorption equation
- Discuss the properties of surfactant solutions
- Derive the expressions of the adsorption isotherms
- Derive the equations relative to the electrokinetic phenomena
- Discuss the stability of colloids according to the DLVO model
- Discuss the scattering of light by small particles

Transversal skills

- Use a work methodology appropriate to the task.
- Assess one's own level of skill acquisition, and plan their on-going learning goals.

Teaching methods

Ex cathedra lectures and exercises

Expected student activities

Reading the lecture notes and solving the exercises

Assessment methods

Written examination.

Supervision

Office hours	No
Assistants	Yes
Forum	No

Resources

Bibliography

See lecture notes.

Notes/Handbook

Lecture notes

Websites

- http://scgc.epfl.ch/telechargement_cours_chimie