KD2350 Surfaces, Colloids and Soft Matter 7.5 credits

Ytor, kolloider och mjuka material

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for KD2350 valid from Autumn 2011

Grading scale

A, B, C, D, E, FX, F

Education cycle

Second cycle

Main field of study

Chemical Science and Engineering,Chemistry and Chemical Engineering

Specific prerequisites

Admission requirements for programme students at KTH:
At least 150 credits from grades 1, 2 and 3 of which at least 110 credits from years 1 and 2, and bachelor's work must be completed, within a programme that includes:
75 university credits (hp) in chemistry or chemical engineering, 20 university credits (hp) in mathematics and 6 university credits (hp) in computer science or corresponding.

Admission requirements for independent students:
75 university credits (hp) in chemistry or chemical engineering, 20 university credits (hp) in mathematics and 6 university credits (hp) in computer science or corresponding. Documented proficiency in English corresponding to English B.

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The aim of the course is to provide a broad, fundamental basis in surface and colloid chemistry and its applications.

After completing the course, a student should be able to:

• Identify the various types of colloidal systems and classify them according to their thermodynamic stability.

• Identify, describe and predict the phase behaviour of multicomponent systems in terms of molecular properties and self-assembly.

• Understand and describe the nature of surface active agents and the driving forces for their adsorption to various types of interfaces. Calculate the interfacial concentration from surface tension and/or bulk concentration data.

• Explain interfacial charging mechanisms

• Understand the principles driving the adsorption of polymers and polyelectrolytes, and the formation of polyelectrolyte complexes.

• Account for the stability or otherwise of a colloidal system in terms of the surface forces acting between the constituent particles and predict behaviour in response to changes in composition.

• Calculate the magnitude of the surface forces acting between arbitrary surfaces/particles in a given medium.

• Understand and apply quantitatively the basic principles of surface thermodynamics to explain and calculate the effect of surface tension, contact angles, wetting behaviour and related phenomena.

• Understand the design principles and requirements for superhydrophobicity and superhydrophilicity.

• Identify suitable approaches for Surface modification of a particular surface to achieve specific properties

• Explain quantitatively the relationship between adhesion, surface energy and adsorption.

• Identify and describe the surface chemical principles involved in industrial processes such as paper making, froth flotation, and detergency.

Course contents

Principles of Surface and Colloid Science

Thermodynamics of surface tension, adsorption and interacting surfaces, as well as the relevant experimental approaches.

Capillarity

Electrostatics of interfaces and titration of surface charge

Electrokinetic phenomena

Surface forces: double layer forces, van der Waals forces, steric forces, hydration forces and colloidal stability

Stablising dispersions

Adhesion

Wetting, including superhydrophobicity.

Applications of surface chemistry, with focus on paper industry, flotation and cleaning

Adsorption: From gases and liquids, including polymers, polyelectrolytes and the formation of polyelectrolyte complexes. Solution behaviour of polyectrolytes.

Surface modification

Surfcatant properties and association to micelles, vesicles, liquid crystals and biomembranes.

Emulsions, microemulsions and foams.
Gels

Course literature

K. Holmberg et al. Surfactants and Polymers in Aqueous Solution John Wiley & Sons, 2002

Material divided during the course.

Examination

- LAB1 - Laborations, 2.0 credits, grading scale: P, F
- TEN1 - Written exam, 5.5 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH’s coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Other requirements for final grade

Laboratory Work (LAB1; 2 credits)
Examination (TEN1; 5.5 credits)

Final grade will be the same as the grade of the examination.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.