KF2200 Physical Polymer and Cellulose Chemistry 7.5 credits

Fysikalisk polymer- och cellulosakemi

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

Establishment

Course syllabus for KF2200 valid from Autumn 2019

Grading scale

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

Education cycle

Second cycle

Main field of study

Chemical Science and Engineering

Specific prerequisites

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.

Language of instruction

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

Intended learning outcomes

After the course the student should know:

- Molecular basis for properties of polymers and wood fibres.
- The connection between the properties of the smallest building stones in polymers and wood fibres and the properties of products made of polymers and wood fibres.
- How different transport processes in fibres and polymers are connected to the physical and chemical structure of fibres and polymers.
- Surface chemistry and surface physics of polymers and fibres, also how these are determined experimentally.
- How to change the properties of polymers and fibres by chemical and physical modification
- How to use chemical specialist literature.

Course contents

1. Chain conformation of macromolecules: stereo forms of small molecules by torsion around sigma bond and energy analysis, statistical weight matrix, important statistical conditions of macromolecules, theta condition, chain with excluded volume, collapsed conditions, chain with preferable conformation (crystal form), random-walk analysis.
2. Elasticity of macromolecular networks: rubber elasticity theory, classical and modern development trends, gels including hydrogels and polyelectrolyte gels – qualitative analysis, Flory-Rehner's theory, polyelectrolyte gels theory.
3. Polymer solutions: Flory-Huggin's equation, solubility parameter, polyelectrolytes
4. Structure determination methods: Thermal analysis, spectroscopy , diffraction- and spread methods, microscopy, surface physical methods.
5. Surface physical properties of polymer and wood fibre materials.
6. Glassy state of polymers and fibre wall composites: kinetic aspects – phenomenology and theories (among other things the KAHR-model), theories for glass transition, influence of structure on glass temperature, application cases: fibre wall components.
7. The hierarchy of cellulose structure in the fibre wall.
8. The structure hierarchy of part crystalline polymers: single crystals, chain folding, dislocations, epitaxial growth, crystal units, over structures, crystal growth theories, connections between molecular structure and morphology, relation between melting point and structure.
9. Transport properties of polymers and wood fibre materials: basic connections for material transport, molecular theories for material transport, complex systems, application cases: wood fibre materials.

Examination

- TEN1 - Examination, 7.5 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.

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

Other requirements for final grade

Examination, 7,5 credits

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.