LUNDS UNIVERSITET
Lunds Tekniska Högskola

Course syllabus

Polymerfysik
Polymer Physics

KASN20, 7,5 credits, A (Second Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED B/K
Date of Decision: 2023-04-18

General Information

Compulsory for: K4-m
Elective for: N4-m
Language of instruction: The course will be given in English on demand

Aim

The course shall give the necessary special knowledge required to read scientific literature in the area of polymer physics, and to participate in research and development within industries that produce or use polymers.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

- be able to describe and analyse general concepts in polymer physics.
- be able to describe and explain in general terms the molecular mobility of polymers and polymer blends as a function of temperature.
- be able to describe different principles and methods for the determination of thermal, mechanical, dielectric, rheological and free volume properties.
- be able to relate molecular structure with important polymer properties.
- be able to describe different principles and methods for the processing of polymers and polymer composites.

Competences and skills
For a passing grade the student must

- be able to use and evaluate general methods for the characterization of polymers,

including dynamic mechanical spectroscopy, differential scanning calorimetry and the determination of crystallization kinetics.
- be able to solve some problems through calculations from theory including mechanical properties, time-temperature superposition principles and crystallization kinetics.
- be able to discuss the behaviour of heterogeneous polymer systems.
- be able to understand and use concepts in polymer physics in spoken and written English.

Judgement and approach
For a passing grade the student must

have insight in the relevance of polymer physics in research and development activities of polymer producing, polymer processing and polymer using industries.

Contents

The course includes the physical properties of polymers in the crystalline state, the amorphous state, mechanical and rheological properties, structure-property relations and processing.

- Crystalline state: mechanisms of crystallization and melting, morphology and kinetics.
- Amorphous state: mobility, viscoelastic behaviour, reptation model, viscosity, glassy state and free volume.
- Mechanical and rheological properties: viscoelastic properties and models, linear viscoelasticity, dynamic mechanical and dielectric analysis, molecular theory of viscoelasticity.
- Structure-property relations: Melting and glass transition temperature, copolymers, plasticizers, fillers and crystallinity.
- Processing: injection moulding, extruding, single screw and double screw extruders, blow moulding, calendering, vacuumforming, thermoforming, coating, filement winding and pultrusion.

The theoretical contents of the course are discussed during the lectures. The ability of the student to solve problems in polymer physics is practised during the exercises. Through home assignments, the student will practise his or her ability to independently solve problems. Selected main topics are treated during practical laboratory exercises. During visits to local industries, the student will be introduced to modern production and development activities in the area.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written exam. Approved laboratory assignments and participation in compulsory visits to polymer industries. The final mark of the course is given by the final score on the written exam.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Admission

Admission requirements:

- KASF05 Materials and Polymer Technology or KASF10 Functional Materials

Assumed prior knowledge: KASN25 Polymer Chemistry.
The number of participants is limited to: No
The course overlaps following course/s: KPO010

Reading list

- J.M.G. Cowie, V. Arrighi: Polymers: Chemistry & Physics of Modern Materials, 3rd edition. CRC Press, 2008, ISBN: 978-0-8493-9813-1.
- Lab compendium, exercises and other material provided by the Division.

Contact and other information

Course coordinator: Professor Patric Jannasch, patric.jannasch@chem.lu.se
Course homepage: http://canvas.education.lu.se