

MSE-431

Physical chemistry of polymeric materials

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Cursus	Sem.	Type
Chimiste	MA2, MA4	Opt.
Ing.-chim.	MA2, MA4	Opt.
Materials Science and Engineering	MA2, MA4	Opt.

Language of teaching	English
Credits	4
Session	Summer
Semester	Spring
Exam	During the semester
Workload	120h
Weeks	14
Hours	4 weekly
Courses	3 weekly
Exercises	1 weekly
Number of positions	

Summary

The student has a basic understanding of the physical and physicochemical principles which result from the chainlike structure of synthetic macromolecules. The student can predict major characteristics of a polymer from its chemical structure and molecular architecture.

Content

- Introduction
- Dilute solutions
- Polymer structure in solution
- Molecular weight determination
- Concentrated solutions and phase behavior
- Characterization methods
- The amorphous state
- The crystalline state
- The glass-rubber transition
- Rubber elasticity
- Viscoelastic properties
- Polymer Surfaces and Interfaces: models and characterization techniques

During the course concepts, characterization methods and models are discussed in the field of the above mentioned subjects.

Keywords

dilute and concentrated solutions
 amorphous and crystalline state
 glass transition
 rubber elasticity
 viscoelastic behaviour
 surface and interface

Learning Prerequisites**Recommended courses**

General chemistry, organic and polymer chemistry

Important concepts to start the course

basic knowledge of thermodynamics
elementary laws of chemistry and physics

Learning Outcomes

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

- Predict polymer characteristics based on chemical structure and molecular architecture
- Use insights from physicochemical experiments to discuss the composition and architecture of polymers
- Discuss dilute and concentrated solutions and bulk behaviour of synthetic polymers
- Work out / Determine a characterization method for a given problem
- Assess / Evaluate experimental results regarding to the discussed models

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.
- Continue to work through difficulties or initial failure to find optimal solutions.

Teaching methods

Lectures with integrated exercises; lab works in small groups

Expected student activities

mandatory presence on lab work

Assessment methods

in 2 parts:

1. written report, in the form of a literature study
2. practical lab work during class hours and presentation of results in person during class.

Supervision

Office hours	No
Assistant.e.s	Yes
Forum	Yes
Others	via Moodle

Resources

Bibliography

1. T.P. Lodge, P.C. Hiemenz, Polymer Chemistry, 3rd edition, CRC Press 2020
e-book:
<http://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=2512676>
hardcopies are available at the library
2. L.H. Sperling, Introduction of Physical Polymer Science
4th edition, Wiley Interscience 2005
3. M. Rubinstein, R.H. Colby, Polymer Physics, Oxford University Press 2003
4. S. Wu, polymer Interface and Adhesion, Marcel Dekker, Inc. 1982

Ressources en bibliothèque

- [Find the references at the Library](#)

Notes/Handbook

Slides and notes are available on Moodle

Moodle Link

- <https://go.epfl.ch/MSE-431>