INSA INSTITUT NATIONAL DES SCIENCES APPLIQUÉES LYON

DPT SCIENCE ET GENIE MATERIAUX
MATERIALS SCIENCE AND ENGINEERING
INSA Campus LyonTech - 7-9 Avenue Jean Capelle
Batiment Blaise Pascal - 69621 VILLEURBANNE
Phone 0472438203

Polymers

Polymer materials: Macromolecular design and chemical-physics

IDENTIFICATION

CODE : SGM-4-S2-PC2POLY
ECTS : 2.0

HOURS

Lectures :	16.0 h
Seminars :	10.0 h
Laboratory :	0.0 h
Project :	0.0 h
Teacher-student contact :	26.0 h
Personal work :	20.0 h
Total :	46.0 h

ASSESSMENT METHOD

One written examination [1h30]

TEACHING AIDS

course notes

TEACHING LANGUAGE

French

CONTACT

M. FLEURY Etienne
etienne.fleury@insa-lyon.fr

AIMS

The objectives at the end of the course are:
-Basic knowledge of the design of macromolecular networks [thermosets¿]
-Characterization of linear polymers in solution and of macromolecular networks

This EC SGM-4-S2-PC2POLY falls under the SGM-4-UE-SDM-S2 Material Science Teaching Unit Semester 2 and contributes to:

School skills in science for engineers

A5 - Process data [Level 2]
A6 - Communicate an analysis or a scientific approach with scenarios adapted to their specialty [Level 1]

Specialty-specific school skills:
C1 - Knowing and being able to establish the Structure-Property relationships of Materials [Level 2]
C2 - Identify and implement materials development methods [Level 1]
C4 - Modeling and predicting the behavior of materials [Level 2]

By mobilizing the following skills:
A2 - Use a model of a real or virtual system
A3 - Implement an experimental approach
A4 - Design a system that meets specifications
B2 - Work, learn, evolve independently
C3 - Apply materials

By allowing the student to work and be assessed on the following knowledge:

- Know how to explain the mechanisms of dissolution of polymers in a solvent medium,
- Understand the origins of polymer/solvent interactions,
- Know how to use and understand the equations and relations resulting from the theories of Flory-Huggin and Flory-Krigbaum
- Know and know how to use the characterization techniques of polymers in solution diluted or semi-diluted,
- Know the chemistry of the main crosslinkable materials: polyurethane, unsaturated polyesters, epoxy/amine, silicone, etc.
- Know and know how to explain the phenomena of gelation and vitrification
- Know how to calculate the molar mass between crosslinking nodes.
- Know how to propose recycling methodologies

CONTENT

Part 1: Polymers in solution
- Solubility and behavior in solution [Flory-Huggins and Flory-Krigbaum].
- Measurement techniques of molar masses
- Application to recycling approaches

Part 2: Polymer networks
- Synthesis and structural transformations [gelation, vitrification, phase diagrams and rheology].
- Characterization of networks [swelling, rubber elasticity], model networks, etc.
- Some examples of processing.
- Thermosets recycling strategies [vitrimers, etc.]

BIBLIOGRAPHY

[1] L.H SPERLING, Introduction to Physical Polymer Science, John Wiley & Sons, Inc. (2006)
[2] M FONTANILLE, Y GNANOU Chimie et physico-chimie des polymères, Editions Dunod (3ème édition 2013)
[3] JP PASCAULT, H. SAUTEREAU, J. VERDU, RJJ. WILLIAMS Thermosetting Polymeres Editions Dekker (2002)
[4] HH KAUSCH, N HEYMANS, CJ PLUMMER, P DECROLY, Matériaux Polymères : propriétés mécaniques et physiques, Presse polytechnique et universitaires Romandes (2001)
[5] T HAMAIDE, L FONTAINE, JL SIX Chimie des polymères, exercices et problèmes corrigés, Editions Lavoisier (2ème édition 2014)

PRE-REQUISITE

SGM-3-PCMMOL (basic knowledge of chemical-physics of polymers)

INSA LYON
Campus LyonTech La Doua
20, avenue Albert Einstein - 69621 Villeurbanne cedex - France
Phone +33 (0)4 72 43 83 83 - Fax +33 (0)4 72 43 85 00
www.insa-lyon.fr