

SYLLABUS

Name: Polymer Materials (WTCCXCSE-PM)

Name in Polish:

Name in English: Polymer materials

Information on course:

Course offered by department: Faculty of Advanced Technologies and Chemistry

Course for department: Faculty of Advanced Technologies and Chemistry

Term: Winter semester 2024/2025 Year

Cordinator of course edition: prof. dr hab. inż. Marzena Tykarska

Default type of course examination report:

Exam

Language:

English

Short description:

Basic information about polymers.
Reactions of synthesis. Structure of macromolecules.
Structure and morphology of polymers.
Mechanical properties. Thermal properties. Resistivity to solvents.
Relationship between the structure, properties and per-formance.
Modification of properties. Additives.
Measurements of properties.
Technology of polymer synthesis. Processing of poly-mer materials.
Plastics – classification, properties and applications
Elastomers – classification, properties and applications.
Novel polymers. Liquid crystal polymers. Polymer composites.
Recycling

Description:

Basic information about polymers.
History. Advantages and disadvantages. Macromolecules and polymer materials. Nomenclature. Comparison to other engineered materials. Basic terms: monomers, oligomers, mers, polymers, copolymers.
Reactions of synthesis. Structure of macromolecules.
Condensation and addition polymerizations. Atoms. Bonds. Configuration. Stereoregularity. Conformation.
Structure and morphology of polymers.
Number average and weight average molecular weight. Distribution of molecular weight. Degree of polymerization. Degree of cross-linking. Chain structure - linear, branched and networked. Dendrimers. Copolymers. Crystalline and amorphous morphology.
Mechanical properties. Thermal properties. Resistivity to solvents.
Mechanical states. Transitions in polymers. Resistivity to water, inorganic and organic solvents
Relationship between the structure, properties and performance.
Modification of properties. Additives.
Chemical and physical modifications of properties. Types of additives and they role in polymer materials.
Measurements of properties.
Mechanical: Strength. Hardness. Dynamic strength. Elasticity. Thermal: DTG, DTA, DSC, dilatometry. Structure: spectrometry.
Identification of polymer materials. Thermal resistivity.
Technology of polymer synthesis. Processing of polymer materials.
Wet methods. High temperature methods (molding, injection molding, extrusion). Low pressure methods. Rubber vulcanization.
Plastics – classification, properties and applications
Thermoplastics – carbochain and heterochain. Thermosets. Fibers. Foils. Surface coatings. Adhesives.
Elastomers – classification, properties and applications.
Novel polymers. Liquid crystal polymers. Polymer composites.
Recycling

Bibliography:

Obligatory:

Hiemenz Paul C., Lodge Timothy P., "Polymer Chemistry", ed. CRC PR INC, 2007
Calhoun Allison, Peacock Andrew J., "Polymer Chemistry", ed. Hanser Fachbuchverlag, 2006
Tadmor Zehev, Gogos Costas G., "Principles of Polymer Processing", ed. John Wiley & Sons, 2006

Complementary:

J. Brandrup, "Polymer Handbook", 4th ed., John Wiley & Sons, 1999
E. Kaufmann, Characterization of Materials, John Wiley & Sons, 2003

Learning outcomes:

to introduce into basic physical and chemical properties of polymer materials and methods of their investigation
to introduce into application of different kinds of polymer materials
to introduce into technology of processing

to teach the relation between structure, properties and performance
to teach identification of polymer materials

Assessment methods and assessment criteria:

written exam

presence during laboratories, reports

presentations on given subject

Practical placement:

not applicable

Mode of study
full-time studies
Form of study
LLP Erasmus
Introductory subjects
General and physical chemistry Mechanics and strength
Programs
Degree programmes: 1. Materials Engineering 2. Chemistry Specialization: all specializations Degree of studies: undergraduate and graduate (1st and 2nd degree)
Form of course / number of hours / final requirement
lectures 28h/exam laboratories 16h/credit seminars 16h/credit
Author
prof. Marzena Tykarska
Information on course edition:
Default type of course examination report:
Exam
Bibliography:
<i>missing bibliography in English</i>