COURSE DESCRIPTION CARD - SYLLABUS

Course name
Chemia polimerów (Chemistry of polymers)

Course

Field of study
Technologia chemiczna (Chemical Technology)
Year/Semester
I/1
Area of study (specialization)
Technologia polimerów (Polymer Technology)
Profile of study
general academic
Level of study
Second-cycle studies
Course offered in
Polish
Form of study
full-time
Requirements
compulsory

Number of hours

Lecture	Laboratory classes	Other (e.g. online)
30	45	
Tutorials	Projects/seminars	

Number of credit points

5

Lecturers

Responsible for the course/lecturer:
Agnieszka Marcinkowska, D.Sc., Eng.
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Responsible for the course/lecturer:

Prerequisites

Student starting this subject should have knowledge of the basic principles of general, organic, physical chemistry, and chemical engineering, as well as subjects taught at “Chemical technology – polymeric materials".
Student knows and applies good practices of laboratory work, is able to operate the scientific equipment as well as is able to search for information in scientific literature, databases and other properly chosen sources.

Course objective

Gaining basic knowledge of the chemistry of chain and step polymerization processes, modern methods of controlled polymerization, chemical reactions of polymers, as well as gaining skills related to methods of synthesis, modification, degradation of polymers and basic methods of analysis of plastics.

Course-related learning outcomes

Knowledge

Student has expanded and well-established knowledge in the field of polymer chemistry and other related areas of science, allowing to formulate and solve complex tasks related to polymer technology (K_W2). Student has expanded knowledge in the field of kinetics, thermodynamics, catalysis of polymerization processes (K_W4). Student has a well-established and expanded knowledge of methods and mechanisms of polymer synthesis and modification (K_W11). Student has established knowledge of occupational health and safety in the polymer chemistry laboratory (lists and applies health and safety regulations) (K_W10).

Skills

Student has the ability to obtain and critically evaluate information from literature and other sources (K_U1). Student works in a group to prepare and perform experiments in the laboratory (K_U2). Student has the ability to present the results of laboratory exercises in a concise and proper manner (K_U6). Student has the ability to analyze and interpreting of the results of experiments from the area of polymer chemistry. (K_U21). The student has the ability to use the knowledge acquired under the specialty in a professional career (K_U23). Student knows and obeys the safety rules related to the work performed (K_U19).

Social competences

Student is conscious of limitations of science and technology in the area of polymer chemistry, including environment protection (K_K2). Student is conscious of limitation of his knowledge and understands the need of further continuous education in area of polymer chemistry (K_K1). Students can work in a team and are aware of their responsibility for their work and responsibility for the results of the teamwork (K_K4).

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Lecture. Written exam (consisting of 5 open questions) from the area of polymer chemistry presented during the lectures (student obtains a pass by achieving at least 51% of points).

Laboratory classes. The grade consists of the obligatory performance of all laboratory exercises included in the program, positive grades from theoretical preparation for exercises (tests consisting of 3 to 5 questions), activity during classes, method of conducting experiments and preparation of reports.

Programme content

The lecture covers the following topics:
Processes of polymer synthesis and reaction mechanisms.
Thermodynamics of polymerization.
Radical polymerization: initiators, monomers, steps of reaction, polymerization kinetics, linear polymerization, polymerization with crosslinking, copolymerization, controlled („living”) radical polymerization.
Ionic polymerization: anionic, cationic, living. Kinetics of ionic polymerization.

Coordination polymerization: process characteristics, catalysts, mechanisms.
Polymerization by metathesis.
Highly branched polymers.
Thiol-ene polymerization.
Polycondensation: polycondensdation control, kinetics of chain formation, polycondensation of di- and multifunctional monomers, gel point, Flory's distribution.
Polyaddition.
Chemical reactions of polymers, degradation and stabilization of polymers.

The laboratory classes covers the following issues:

Reactions leading to a reduction in the molecular weight of the polymer. Preparation of light-curing varnishes by photopolymerization and methods for testing the properties of painting materials and coatings. Theoretical basics of the polycondensation process (reaction mechanism, chemistry and polycondensation methods, properties and application of condensation polymers). Basic methods for identification of plastics (thermal decomposition, solubility, color reactions, elemental analysis, determination of characteristic numbers, determination of water, spectroscopic methods). Chemical reactions leading to polymer modification. Copolymerization (process kinetics, reactivity factors, types of copolymers).
1. Depolymerization on the example of PMMA and PS.
2. Preparation of light-cured varnishes and investigating its properties.
3. Polyesterification kinetics.
4. Polymer identification.
5. Chemical modification of polymers - obtaining cellulose triacetate.
6. Copolymerization of styrene with maleic anhydride.

Teaching methods

Lecture: informative lecture with multimedia presentation.

Laboratory classes: performing experiments and getting acquainted with research equipment and chemical reagents used in their conduct.

Bibliography

Basic

1. Chemia polimerów, J. Pielichowski, A. Puszyński , TEZA, Kraków, 2004
2. Chemia polimerów tom I, Praca zbiorowa pod red. Z. Floriańczyka i S. Penczka , Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa , 1995

Additional

1. Principles of Polymerization, 4-th edition, G. Odian , Wiley-Intersciene:Hoboken, New York, 2004
2. Principles of Polymer Chemistry, 2-nd edition, A.Ravve, Kluver Academic/Plenum Publishers, New York, 2000
3. Handbook of radical polymerization, K. Matyjaszewski, T.P. Dawis, Wiley Interscience, 2002

Breakdown of average student's workload

	Hours	ECTS
Total workload	125	5,0
Classes requiring direct contact with the teacher	75	3,0
Student's own work (literature studies, preparation for laboratory classes, preparation for exam and tests) [1]	50	2,0

[1] delete or add other activities as appropriate