COURSE DESCRIPTION CARD - SYLLABUS

Course name
Technologia materiałów polimerowych (Polymer materials technology)

Course

Field of study
Technologia chemiczna (Chemical Technology)
Year/Semester
4/7
Area of study (specialization)
Profile of study
general academic
Level of study
First-cycle studies
Course offered in
Polish
Form of study
part-time
Requirements
compulsory

Number of hours

Lecture
Laboratory classes
20
Other (e.g. online)
Tutorials
10
Projects/seminars

Number of credit points

4

Lecturers

Responsible for the course/lecturer:
Agnieszka Marcinkowska, D.Sc., Eng.
Faculty of Chemical Technology
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Responsible for the course/lecturer:
Sławomir Borysiak, D.Sc., Eng.

Prerequisites

Student starting this subject should have knowledge of the basic principles of general, organic, physical chemistry, and chemical engineering.
Student knows and applies good practices of laboratory work, is able to operate the scientific equipment. Student should have the ability to obtain information from scientific literature, databases and other properly selected sources.

Course objective

Gaining basic knowledge about polymers, polymer materials, their synthesis (chain and step polymerization reactions, steps of polymerization reactions, kinetics of polimerization, technical methods of polymerization), properties and areas of application.

Course-related learning outcomes

Knowledge

Student has expanded and well-established knowledge in the field of polymer structure, polymer preparation methods and their properties and processing (K_W08). The student has a basic knowledge of development trends in the field of polymeric materials and their applications in the plastics industry (K_W09). The student knows the basic methods used to solve simple tasks in the field of polymer material technology (K_W15).

Skills

Student has the ability to obtain and critically evaluate information from literature and other sources (K_U01). Student works both individually and in a group (K_U02). Student distinguishes between types of reactions in obtaining polymers and has the ability to select them for chemical processes (K_U18). The student has the ability to use the basic laboratory techniques in the field of polymer chemistry and processing as well as the properties of plastics (K_U20).

Social competences

Student understands the need of further continuous education in area of polymer chemistry (K_K01). the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment and the associated responsibility for decisions (K_K02). Students can work in a team and are aware of their responsibility for their work (K_K03).

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Tutorials. Solving problems during classes. Final test.

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 tutorial covers the following issues:
Radical polymerization: radical polymerization stages: initiation (and initiators), propagation, termination (types, consequences of chain transfer reactions, regulation of molecular weight, kinetics of free radical polymerization).
Ion polymerization (anionic and cationic): initiators, monomers, stages and mechanism of polymerization, living polymerization.
Polycondensation: types of polycondensation, comparison of radical polymerization and polycondensation, the most important characteristics and quantities describing the process, equilibrium and non-equilibrium polycondensation, bifunctional and multifunctional polycondensation, Carothers equation.
Polyaddition, characteristics, examples.
Crosslinking of polymers: crosslinking methods, examples, vulcanization.

The laboratory covers the following issues:
Mechanism of radical polymerization (initiation, steps, kinetics, gel effect, polymerization shrinkage).
Industrial methods of polymerization. Polycondensation mechanism. Polycondensation degree.

Chemistry and methods of conducting polycondensation. Chemistry and technology of obtaining foamed polyurethanes. Impact of substrate structure on the properties of cellular materials. Industrial methods for the production of cellular plastics. Basic methods for identifying plastics (thermal decomposition, solubility, color reactions, elemental analysis, determination of characteristic numbers, determination of water, spectroscopic methods).

1. Radical block polymerization.
2. Polycondensation - obtaining an alkyd resin from glycerin and phthalic anhydride.
3. Preparation of polyurethane foams, water absorption test.
4. Identification of polymer materials.

Teaching methods

Tutorial. Auditorium exercises: solving tasks.

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

Bibliography

Basic

1. Z. Floriańczyk, S. Penczek, Chemia Polimerów, t.I i II, Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001
2. J. Pielichowski, A. Puszyński, Technologia tworzyw sztucznych, WNT, Warszawa 2003
3. J. Pielichowski, A. Puszyński, Chemia polimerów, TEZA, Kraków 2004
4. J.F. Rabek, Współczesna wiedza o polimerach, PWN, Warszawa 2008
5. B. Łączyński, Tworzywa wielkocząsteczkowe: rodzaje i własności, WNT, Warszawa 1982.

Additional

1. I. Gruin, Materiały polimerowe, PWN, Warszawa 2003
2. D. Żuchowska, Polimery konstrukcyjne, WNT, Warszawa 2000
3. K. Czaja, Poliolefiny, WNT, Warszawa 2005
4. Principles of Polymerization, 4-th edition, G. Odian , Wiley-Intersciene:Hoboken, New York, 2004
5. Principles of Polymer Chemistry, 2-nd edition, A.Ravve, Kluver Academic/Plenum Publishers, New York, 2000
6. Handbook of radical polymerization, K. Matyjaszewski, T.P. Dawis, Wiley Interscience, 2002

Breakdown of average student's workload

	Hours	ECTS
Total workload	100	4,0
Classes requiring direct contact with the teacher	33	1,5
Student's own work (literature studies, preparation for laboratory classes and tutorials, preparation for tests/exam) [1]	67	2,5

[1] delete or add other activities as appropriate