



## COURSE DESCRIPTION CARD - SYLLABUS

Course name

Selected recycling technologies of foamed materials [S1TOZ1>WTRMS]

### Course

Field of study

Circular System Technologies

Year/Semester

3/6

Area of study (specialization)

–

Profile of study

general academic

Level of study

first-cycle

Course offered in

polish

Form of study

full-time

Requirements

elective

### Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

0

Tutorials

0

Projects/seminars

0

### Number of credit points

3,00

### Coordinators

dr inż. Przemysław Bartczak

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### Lecturers

### Prerequisites

The student should have basic knowledge in the field of organic chemistry, polymers and plastic materials and chemical engineering. The student should also have the ability to search information from literature, scientific databases and other properly selected sources, and show willingness to team-working. Understanding the necessity of training, understanding the need to extend one's competences.

### Course objective

Obtaining basic knowledge in the field of chemistry of expand polymeric materials. Study of selected technological processes and unit operations related to the recycling of foamed materials. Indication of the possibility of reusing products manufactured in the recycling of foamed polymers.

### Course-related learning outcomes

Knowledge:

k\_w03 - has knowledge of organic chemistry and polymer chemistry necessary to describe the concepts and principles of the recycling technology of foam polymeric materials.

k\_w04 - has an ordered, theoretically founded general knowledge in the field of organic chemistry, polymers and plastics, which allows for understanding and description of chemical processes related to

the technology of recycling foamed materials.

k\_w06 - knows the principles of environmental protection related to chemical production and the management of raw materials, materials and waste in the production technology of foamed materials.

k\_w12 - has a basic knowledge of the life cycle of products, devices and installations in the chemical industry.

Skills:

k\_u01 - can obtain information from literature, databases and other sources related to the technologies of recycling of foamed materials, also in a foreign language, integrate them, interpret them, draw conclusions and formulate opinions.

k\_u04 - has the ability to self-study.

k\_u08 - is able to plan and organize work individually and in a team

Social competences:

k\_k05 - the student understands the need for further education and improving his professional and personal competences.

k\_k10 - is aware of the importance and understanding of non-technical aspects and effects of engineering activities, including its impact on the environment and the related responsibility for decisions made.

### Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

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Completion of the course - the knowledge acquired during the lecture is verified in the form of a written test after the end of the lectures. Written test in the form of open-ended questions concerning the issues presented in the lecture (the student obtains a credit with at least 51% of the points). The issues for the test will be presented to students at the lecture or sent by e-mail using the university's e-mail system.

### Programme content

The lecture covers the following topics:

1. Characteristics of foamed materials (classification, basic raw materials used in the production of foamed polymers, including polyurethanes, polyethylene, polypropylene and polystyrene, foaming agents of polymeric materials).
2. Methods of producing foamed materials (foaming methods and technologies, industrial installations for the preparation of polymer foamed materials).
3. The latest achievements in the field of technology of polymeric foamed materials and their technical applications.
4. Recycling of polyurethane foams (material recycling - pressing with binders, reactive sintering and recovery of raw materials - glycolysis, including other chemical recovery methods).
5. Recycling of expanded polystyrene, polypropylene, polyethylene (material recycling - techniques and equipment used).
6. Reuse and foaming of polymer waste as one of the forms of recycling (technologies of re-foaming, methods of foaming of polymeric materials, industrial installations for re-foaming of polymeric materials, foaming of polymer composites with cellulose fillers).

### Teaching methods

Lecture: multimedia presentation

### Bibliography

Basic

1. J. Rabek „Polimery”, PWN, Warszawa 2013
2. A. Prociak, G. Rokicki, J. Ryszkowska „Materiały poliuretanowe”, PWN, Warszawa 2014
3. Z. Wirpsza „Poliuretany. Chemia, technologia, zastosowanie”, WNT, Warszawa 1991
4. J. Ryszkowska „Materiały poliuretanowe wytwarzanie z zastosowaniem surowców odnawialnych”, WPW, Warszawa 2019
5. J. Kijewski, A.K. Błędzki, R. Jeziórska, „Odzysk i recykling materiałów polimerowych”, PWN, Warszawa

2014

Additional

1. D. Żuchowska, Polimery konstrukcyjne, WNT, Warszawa 2000

2. Z. Floriańczyk, S. Penczek, Chemia Polimerów, t.I , Oficyna Wydawnicza Politechniki Warszawskiej, Warszawa 2001

### Breakdown of average student's workload

	Hours	ECTS
Total workload	75	3,00
Classes requiring direct contact with the teacher	38	1,50
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	37	1,50