COURSE DESCRIPTION CARD - SYLLABUS

Course name

Surface phenomena and catalysis

Course

Field of study

Chemical Technology

Year/Semester

I/1

Area of study (specialization)

Composites and Nanomaterials

Profile of study

general academic

Level of study

Second-cycle studies

Course offered in

English

Form of study

full-time

Requirements

compulsory

Number of hours

Lecture

30

Laboratory classes

0

Other (e.g. online)

Tutorials

0

Projects/seminars

0

Number of credit points

4

Lecturers

Responsible for the course/lecturer:

Elżbieta Frąckowiak, BSc, PhD, DSc, ProfTit

e-mail: elzbieta.frackowiak@put.poznan.pl

Tel. 61 665 3632; room 14A

Faculty of Chemical Technology

Institute of Chemistry and Technical Electrochemistry

ul. Berdychowo 4, 60-965 Poznań

Responsible for the course/lecturer:

Krystyna Prochaska, BEng, PhD, DSc, ProfTit

e-mail: krystyna.prochaska@put.poznan.pl

Tel. 61 665 3601; room 322A

Faculty of Chemical Technology,

Institute of Technology and Chemical Engineering

ul. Berdychowo 4, 60-965 Poznań

Prerequisites

Basic knowledge of general chemistry, physical chemistry, thermodynamics, as well as chemical technology and chemical engineering, and also widely understood environmental protection; ability to obtain information from indicated sources.

Course objective

The aim of the lecture is a synthetic presentation of knowledge on: surface phenomena at the interface:

gas / liquid, liquid / liquid and liquid/solid; basic issues regarding wetting of materials and surface characteristics of solids; surface phenomena in living cells and industrial processes.

The next aim of the lecture is to supply knowledge on homogeneous and heterogenous catalysis with examples of the practical application.

Course-related learning outcomes

Knowledge

K_W4 - has improved knowledge of kinetics, thermodynamics, surface phenomena and catalysis of chemical processes

K_W6 - has improved knowledge of the newest chemical and material technologies, knows current trends in the development of chemical industrial processes

K_W14 - has knowledge of selected aspects of modern chemical knowledge

Skills

K_U1 - has the ability to obtain and critically evaluate information from the literature, databases and other sources, and formulate opinions on this basis

K_U12 - has the ability to adapt knowledge about chemistry and related fields to solve problems in the field of chemical technology and planning new industrial processes

K_U15 - is able to critically analyze industrial chemical processes and introduce modifications and improvements in this area, using the acquired knowledge, including knowledge about the latest achievements of science and technology

Social competences

K_K1 - is aware of the need for lifelong learning and professional development

K_K2 - is aware of the limitations of science and technology related to chemical technology, including environmental protection

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Written/oral exam graded on the basis of a points system (0-100 points)

3	50.1 -70.0 points
4	70.1 -90.0 points
5	90.1 -100 points

Programme content

1. Adsorption (physical adsorption and chemisorption).
2. Adsorption isotherms.
3. Dynamic of adsorption (experimental methods, quantitative description).

4. Adsorption in mixed systems.

5. Wetting and spreading processes (Wenzel and Casie-Baxter model, experimental methods for determining the contact angle).

6. Methods to estimate the surface free energy.

8. Surface modification.

9. Monolayers and thin organized films.

10. Interfacial phenomena in industrial processes.

11. Interfacial phenomena in a living organism, medicine and pharmacy.

12. Catalysts, supports.

13. Homogeneous catalysis (examples).

13. Heterogenous catalysis (industrial examples).

14. Role of catalysis for clean air.

15. Cleaning of exahaust gases by selective catalytic reactions.

15. Biocatalysis, examples of enzymatic catalysis.

Teaching methods

Lecture: multimedia presentation illustrated with examples shown on a blackboard.

Bibliography

Basic

1. P.W. Atkins, Chemia fizyczna, Wyd. Nauk. PWN, Warszawa 2003.

2. M. Ziółek, I. Nowak, Kataliza heterogeniczna wybrane zagadnienia, Wydawnictwo Naukowe UAM, Poznań 1999.

3. B. Grzybowska –Świerkosz, Elementy katalizy heterogenicznej, Wydawnictwo Naukowe PWN 1993.

4. F. Pruchnik, Kataliza homogeniczna, Wydawnictwo Naukowe PWN 1993.

5. Z. Sarbak, Kataliza w ochronie Środowiska, Wydawnictwo Naukowe UAM, Poznań 2004.

6. E. T. Dutkiewicz, Fizykochemia powierzchni, WNT Warszawa 1998.

7. B. Roop Chand, G. Meenakshi, Adsorpcja na węglu aktywnym, WNT Warszawa 2009

8. W. Turek, Z. Uziel, Wykłady i zadania obliczeniowe z kinetyki chemicznej i adsorpcji z elementami katalizy, Wydawnictwo Politechniki Śląskiej 2010

Additional

1. H. Sihgh Nalva (Ed.), Handbook of surfaces and interfaces of materials, Vol. I Surface and interface phenomena, San Diego, Academic Press, 2001.

2. A. Chmiek, Biotechnologia: podstawy mikrobiologiczne i biochemiczne, Wydawnictwo Naukowe PWN 1998.

3. A. James (Ed.), Kent and Riegel's Handbook of industrial chemistry and biotechnology, Vol I, Springer, 2007.

4. M. Bricker, V. Thakkar, J. Petri, Hydrocracking in Petroleum, Processing Springer International Publishing Switzerland, 2015.

5. J. Hagen, Industrial Catalysis: A Practical Approach, Wiley, 2005.

6. H. Robinson (Ed.), Springer Handbook of Petroleum Technology,Springer International Publishing AG, 2017.

Breakdown of average student's workload

	Hours	ECTS
Total workload	80	4,0
Classes requiring direct contact with the teacher	45	2,3
Student's own work (literature studies, preparation for tests/exam) [1]	35	1,7

[1] delete or add other activities as appropriate