GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Surface Phenomena and Industrial Catalytic Processes, PG_00049339		
Field of study	Chemical Technology		
Date of commencement of studies	February 2023	Academic year of realisation of subject	2023/2024
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	5.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Physical Chemistry -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Adam Kloskowski	
	Teachers		

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	15.0	0.0	30.0	0.0	75

E-learning hours included: 0.0

Learning activity and number of study hours

Learning activity	Participation in didactic classes included in study plan	Participation in consultation hours	Self-study	SUM
Number of study hours	75	15.0	35.0	125

Subject objectives

The aim of the course is to familiarize the student who already knows a number of detailed solutions in the field
applications of surface phenomena and catalysis in industrial processes with general principles allowing for the creative application of these phenomena.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K7_U06	The student is able to solve problem tasks related to broadly understood processes running at the interface. Has the ability practical use knowledge gained in the analysis the course of processes catalytic.	[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools
K7_W05	The student will score wide knowledge of the issues kinetics and heterogeneous catalysis with in-depth consideration analysis of chemical transformations in based on the knowledge of the issues surface physicochemistry.	[SW1] Assessment of factual knowledge
K7_U09	The student can use the acquired knowledge to analyze surface processes, including those related to colloid solutions. He is able to choose appropriate measurement techniques and analyze their results.	[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information

<table>
<tr><td>Subject contents</td><td>LECTURE:
Theoretical foundations of surface phenomena: surface tension, adsorption. Methods determination of surface tension. Work of cohesion and adhesion. The surface tension of the solutions i its modification. The use of capillary phenomena and surface tension in technology (flotation, foam). Physical adsorption and chemisorption. Gibbs, Langmuir, Freundlich, BET adsorption isotherms, Frumkin, Tiomkin. Types and classification of adsorbents; their production on an industrial scale. Applications of activated carbons, silica gels and aluminogels in technology. Chemically modified activated carbons (iodized, silvered), their characteristics and industrial applications. Molecular sieves (zeolites and carbon screens). Homogeneous and heterogeneous catalysis. Adsorption as a preliminary stage of catalysis
heterogeneous. Basic types of heterogeneous catalysts (contacts), their desired characteristics and components. The main theories of catalysis and mechanisms of surface reactions. Designing, receiving, operation and examples of applications of heterogeneous catalysts. Kinetics of controlled processes transport. The importance of adsorption in electrochemical processes. Electrocatalysis. Surface engineering - modern techniques of surface modification in the preparation of catalysts. Selected research techniques surface.
EXERCISES:
Performing calculations in the field of surface tension, adsorption and kinetics of controlled reactions transport and catalytic reactions.
Design/Lab:
Independent, critical study by students of selected issues in the field of application of phenomena surface and catalysis in industrial practice using the BIOVIA-Material software Studio.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>knowledge of general, inorganic, organic and physical chemistry at the first-cycle level</td></tr>
<tr><td>Assessment methods and criteria</td><td>
<table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td></td><td>70.0%</td><td>17.0%</td></tr>
<tr><td></td><td>50.0%</td><td>33.0%</td></tr>
<tr><td></td><td>50.0%</td><td>50.0%</td></tr>
</table>
</td></tr>
<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. J. Ościk, Adsorpcja, WNT, Warszawa 1979.
2. E. T. Dutkiewicz, Fizykochemia powierzchni, WNT, Warszawa 1998.
3. B. Grzybowska-Świerkosz, "Elementy katalizy heterogenicznej", Wydawnictwo Naukowe PWN, Warszawa 1993.
4. F. Próchnik, "Kataliza homogeniczna", Wydawnictwo Naukowe PWN, Warszawa 1993.
5. M. Ziółek, I. Nowak, "Kataliza heterogeniczna. Wybrane zagadnienia", Wydawnictwo UAM, Poznań 1999.
6. M. Najbar (red.), "Fizykochemiczne metody badań katalizatorów kontaktowych", Wydawnictwo Uniwersytetu Jagiellońskiego, Kraków 2000.</td></tr>
<tr><td>Supplementary literature</td><td>1. P.C. Niemenz, R. Rajagopalan, Principles of Colloid and Surface Chemistry, Marcel Dekker, Inc., New York, Basel, Hong Kong 1997.
2. J. Hagen, S. Hawkins Industrial Catalysis: A Practical Approach, John Wiley & Son, Ltd; 1999.
3. R. I. Wijngaarden, K. R. Westerterp, A. Kronberg, Industrial Catalysis. Optimizing of Catalysts and Processes, Wiley-VCH Verlag 1998.
4. A. Wieckowski (red.), Interfacial Electrochemistry, Marcel Dekker, New York 1999.</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
</table>
</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Methods of measuring surface tension.

The influence of the size of the interface area on the rate of heterogeneous reaction

Physical adsorption and chemisorption

isotherms, isobars and adsorption isosteres

Adsorption theories

Porous materials

Instrumental methods of surface analysis</td></tr>
<tr><td>Work placement</td><td>Not applicable</td></tr>
</table>