



Subject card

Subject name and code	Surface Science, PG_00061910						
Field of study	Materials Engineering						
Date of commencement of studies	October 2023	Academic year of realisation of subject			2024/2025		
Education level	first-cycle studies	Subject group			Optional subject group Subject group related to scientific research in the field of study		
Mode of study	Full-time studies	Mode of delivery			at the university		
Year of study	2	Language of instruction			Polish		
Semester of study	4	ECTS credits			2.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Electrochemistry and Surface Physical Chemistry -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Jacek Ryl					
	Teachers	dr hab. inż. Jacek Ryl					
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	15.0	0.0	0.0	30
	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	30	2.0	18.0	50		
Subject objectives	The goal of the subject is the presentation of basic problems resulting from the existence of interface between material objects and its surroundings. Discussion of the consequences arising from the existence of surface energy. Analysis of possible applications of surface phenomena in technology. Understanding of problems and benefits resulting from decreasing dimensions of objects with the special emphasis on the semiconductor band structure modification resulting from the surface charge distribution.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W08] Has fundamental knowledge of the development trends in the fields of science and scientific disciplines relevant to materials engineering.	The student has knowledge about development trends in materials engineering, in particular those related to surface processes.			[SW1] Assessment of factual knowledge		
	[K6_W07] Has detailed knowledge of selected problems of materials science.	The student has knowledge about various phenomena specific to the surfaces of materials and the functionality of devices and structures resulting from them.			[SW1] Assessment of factual knowledge		
	[K6_K01] Understands the need to improve professional and personal competencies; is conscious of own limitations and knows when to turn to experts, properly establishes priorities helping to accomplish tasks defined by oneself or others.	The student understands the need to follow the continuous development of material technologies and is able to analyze cause-and-effect relationships.			[SK3] Assessment of ability to organize work		
	[K6_U02] Can operate typical laboratory equipment and analyze material tests	The student is able to operate selected equipment typical for conducting research in the area of surface physicochemistry.			[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject		

Subject contents	<p>Introduction - ideal and real surface.</p> <p>Crystallography of surfaces.</p> <p>Surface tension and thermodynamic description of surfaces.</p> <p>Physical adsorption. Chemisorption and its effect on surface properties.</p> <p>Physics of semiconductor surfaces.</p> <p>Electric double layer</p> <p>Phenomena in colloidal systems, micelles</p> <p>Surface phenomena in industrial technologies (flotation, detergents, etc.).</p> <p>Natural and artificial coatings</p> <p>Selected technologies for producing thin films.</p> <p>During the laboratory, selected aspects related to the above areas will be discussed:</p> <p>Nanoscale topography measurements</p> <p>Study of hydrophilic properties</p> <p>Study of adsorption processes</p> <p>Synthesis of catalytic nanoparticles</p> <p>Study of catalytic properties</p> <p>Electrode processes</p>											
Prerequisites and co-requisites												
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 1592 794 1619">Subject passing criteria</th> <th data-bbox="799 1592 1137 1619">Passing threshold</th> <th data-bbox="1142 1592 1481 1619">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 1626 794 1653">entry test / reports</td> <td data-bbox="799 1626 1137 1653">60.0%</td> <td data-bbox="1142 1626 1481 1653">50.0%</td> </tr> <tr> <td data-bbox="456 1659 794 1686">Written work</td> <td data-bbox="799 1659 1137 1686">60.0%</td> <td data-bbox="1142 1659 1481 1686">50.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	entry test / reports	60.0%	50.0%	Written work	60.0%	50.0%
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Recommended reading	Basic literature	K. W. Kolasinski: Surface Science - Foundations of Catalysis and Nanoscience										
	Supplementary literature	G. Bracco, B. Hols: Surface Science Techniques										
	eResources addresses	Adresy na platformie eNauczanie: Fizykochemia Powierzchni IM 24/25 - Moodle ID: 44788 https://enauzanie.pg.edu.pl/moodle/course/view.php?id=44788										

Example issues/ example questions/ tasks being completed	Definition of surface energy and surface tension. Discussion of the surface influence on semiconductor band structure. Surface effects in technology. Adsorption process description. Analysis of reasons of the segregation effect in alloys.
Work placement	Not applicable

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