



Subject card

Subject name and code	Surface Science, PG_00058944						
Field of study	Nanotechnology						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2024/2025		
Education level	first-cycle studies	Subject group			Obligatory subject group in the field of study 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	3	Language of instruction			Polish		
Semester of study	5	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	1.0		19.0		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_W07	The student has knowledge of surface physicochemistry, understands the influence of nanoscopic parameters on macroscopic properties of materials			[SW1] Assessment of factual knowledge		
	K6_W03	The student is able to discuss the surface electrical, magnetic, optical and mechanical properties.			[SW1] Assessment of factual knowledge		
	K6_K05	Is capable of analysing a scientific publication in English and on its basis prepare an oral presentation in Polish.			[SK4] Assessment of communication skills, including language correctness [SK3] Assessment of ability to organize work		
	K6_U01	The student is able to seek knowledge in the field of surface physicochemistry for the proper solution of engineering problems.			[SU1] Assessment of task fulfilment		
	K6_U02	The student is able to solve scientific problems related to surface processes and the influence of phase boundaries on the properties of materials.			[SU2] Assessment of ability to analyse information		

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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Written work	60.0%	50.0%										
Recommended reading	Basic literature	<p>K. W. Kolasinski: Surface Science - Foundations of Catalysis and Nanoscience</p>										
	Supplementary literature	<p>G. Bracco, B. Hols: Surface Science Techniques</p>										
	eResources addresses	<p>Adresy na platformie eNauczanie: Fizykochemia Powierzchni - 2024/25 - Moodle ID: 40869 https://enauzanie.pg.edu.pl/moodle/course/view.php?id=40869</p>										

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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