



Subject card

Subject name and code	Surface and interface engineering, PG_00070926						
Field of study	Nanotechnology						
Date of commencement of studies	February 2027	Academic year of realisation of subject			2026/2027		
Education level	second-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	1	Language of instruction			Polish		
Semester of study	1	ECTS credits			1.0		
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 -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Jacek Ryl				
	Teachers		prof. dr hab. inż. Jacek Ryl				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	0.0	0.0	15
	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	15	1.0		9.0	25	
Subject objectives	To familiarize students with advanced methods of surface modification and functionalization, in particular with vacuum methods of producing thin films (PVD, CVD) and plasma and laser surface modification processes, and biofunctionalization of interfaces.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W02] has in-depth, theoretically grounded and detailed knowledge of phenomena, methods, and theories related to nanotechnology, as well as of related and allied fields of science or engineering		The student has knowledge of physical, chemical and biological methods, production of thin films and modification of interfaces (PVD, CVD, plasma, etc.), leading to their functionalization.		[SW1] Assessment of factual knowledge		
	[K7_W04] has theoretical and practical knowledge of physical and chemical experimental methods in nanotechnology and understands the principles of their application in processes occurring throughout the life cycle of technical systems		The student has knowledge of surface modification methods as well as methods for verifying the effectiveness of surface engineering.		[SW1] Assessment of factual knowledge		

Subject contents	<p>Course content – lecture The lecture will cover aspects related to the following topics:</p> <ol style="list-style-type: none"> 1. Thin film growth mechanisms: condensation, nucleation, coalescence; in situ process monitoring. 2. Basic film parameters (thickness, adhesion, structure) and methods for their characterization. 3. Types of substrates and their preparation techniques for deposition processes. 4. PVD processes: thermal and electron beam vapor deposition, ion sputtering, reactive techniques. 5. CVD processes: pyrolysis, chemical synthesis, plasma-assisted techniques (PECVD, MW-CVD). 6. Laser surface modification: ablation, hardening, texturing, pulsed deposition (PLD). 7. Applications of thin films in industry and microelectronics. 8. Biofunctionalization of Solid Surfaces Mechanisms and Applications 9. Hybrid Interfaces 10. Mass and Electric Charge Transport at the Nanoscale 11. Kinetics of Interfacial Processes Butler-Volmer and Marcus-Hush Phenomena 12. Advanced Methods for Measuring Thin Films 								
Prerequisites and co-requisites	Fundamentals of chemistry and physics, surface physico-chemistry								
Assessment methods and criteria	<table border="1" data-bbox="448 584 1477 656"> <thead> <tr> <th data-bbox="448 584 794 622">Subject passing criteria</th> <th data-bbox="794 584 1141 622">Passing threshold</th> <th data-bbox="1141 584 1477 622">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="448 622 794 656">written test</td> <td data-bbox="794 622 1141 656">50.0%</td> <td data-bbox="1141 622 1477 656">100.0%</td> </tr> </tbody> </table>			Subject passing criteria	Passing threshold	Percentage of the final grade	written test	50.0%	100.0%
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Recommended reading	<p>Basic literature</p>	<p>Handbook of Surfaces and Interfaces of Materials (2001, Academic Press)</p> <p>Micro- And Nano-Scale Surface and Interface Engineering: Synthesis, Characterization, and Applications (2026, Elsevier)</p>							
	Supplementary literature	Articles in JCR-ranked journals							
	eResources addresses								
Example issues/ example questions/ tasks being completed	<p>Compare the mechanisms of VolmerWeber, Frankvan der Merwe, and StranskiKrastranov thin film growth.</p> <p>Discuss the differences between PVD and CVD processes in terms of growth kinetics, interface quality, and control of chemical composition.</p> <p>Explain how mass and charge transport at the nanoscale affect the kinetics of interfacial processes described by the ButlerVolmer and MarcusHush equations.</p>								
Practical activities within the subject	Not applicable								

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