GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Surface and interface engineering, PG_00071031		
Field of study	Nanotechnology, 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	English
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 leading to surface engineering and its 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

<table>
<tr><td>Subject contents</td><td>Course content – lecture
The lecture will cover aspects related to the following topics:

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</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Fundamentals of chemistry and physics, surface physico-chemistry</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>test</td><td>50.0%</td><td>100.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>Handbook of Surfaces and Interfaces of Materials (2001, Academic Press)

Micro- And Nano-Scale Surface and Interface Engineering: Synthesis, Characterization, and Applications (2026, Elsevier)</td></tr><tr><td>Supplementary literature</td><td>Articles in JCR-ranked journals</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>Compare the mechanisms of VolmerWeber, Frankvan der Merwe, and StranskiKrastanov thin film growth.

Discuss the differences between PVD and CVD processes in terms of growth kinetics, interface quality, and control of chemical composition.

Explain how mass and charge transport at the nanoscale affect the kinetics of interfacial processes described by the ButlerVolmer and MarcusHush equations.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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