GDAŃSK UNIVERSITY
OF TECHNOLOGY

Subject card

Subject name and code	Semiconductor thin-film nanostructures, PG_00071210		
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	Specialty 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	1	Language of instruction	Polish
Semester of study	1	ECTS credits	1.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	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. Wojciech Sadowski	
	Teachers		

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	The aim of the course is to analyze methods of fabricating semiconductor thin films and superlattices to create functional nanomaterials and quantum structures.

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 in-depth, theoretically based knowledge of methods for producing structurally ordered thin-film materials and quantum nanostructures for various applications.	[SW1] Assessment of factual knowledge
[K7_U01] is able to formulate hypotheses, plan and conduct experimental research, critically analyze results, verify hypotheses, draw conclusions, and formulate well-founded opinions within nanotechnology and related physical and natural sciences. Recognizes economic and non-technical aspects of the activities performed	The student is able to learn independently, obtain information from literature and other appropriately selected sources in Polish and English in the aspect of manufacturing nano-sized materials and nanostructures.	[SU3] Assessment of ability to use knowledge gained from the subject

Subject contents	Course content – lecture Heterogeneous nucleation of a new 2D phase - thermodynamics and kinetics of the process. Lattice matching in the crystallization of thin semiconductor films. Vapor phase epitaxy (VPE) and its modifications (MOVPE). Liquid phase epitaxy (LPE), process thermodynamics. Molecular beam epitaxy (MBE), ballistic jet. Non-epitaxial thin film deposition methods (ALD, magnetron deposition). Examples of the fabrication and quantum properties of thin film and nano-sized structures.		
Prerequisites and co-requisites	A course on the basics of physics, chemistry, thermodynamics and an introduction to nanotechnology.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Written examination covering lecture content.	51.0%	100.0%
Recommended reading	Basic literature	**Handbook of Thin-Film Technology**. Edited by Hartmut Frey Hamid R. Khan. Springer-Verlag Berlin Heidelberg 2015. **Handbook of Thin Film Deposition: Theory, Technology and Semiconductor Applications**. Edited by: Dominic Schepis and Krishna Seshan. 2024 Elsevier **2022 Roadmap for Materials for Quantum Technologies**. https://arxiv.org/pdf/2202.07309	
	Supplementary literature	Molecular Beam Epitaxy: Principals, Advantages and Challenges. Mehdi Afshari. Published: 26 June 2025 DOI: 10.5772/intechopen.1011123 A review of molecularbeam epitaxy of wide bandgap complex oxide semiconductors. William Nunn et al. J.of Materials Research, 2021 New Materials, New Functionalities: Molecular Beam Epitaxy of Ultra-High Conductivity Oxides. Gaurab Rimal et al. arXiv:2508.10885v1 [cond-mat.mtrl-sci] 14 Aug 2025; https://arxiv.org/html/2508.10885v1 **Quantum Technologies for Engineering: the materials challenge**. Kuan Eng Johnson Goh et al.. Mater. Quantum Technol. 2 (2022) 013002. ttps://inspirehep.net/files/b07c029658f1fa94e6a494ad3724311d **2022 Roadmap for Materials for Quantum Technologies**. https://arxiv.org/pdf/2202.07309	
	eResources addresses		

Example issues/ example questions/ tasks being completed	Description of the heterogeneous nucleation process. Vapor phase epitaxy (VPE) and its modifications (MOVPE). Liquid phase epitaxy (LPE), process thermodynamics. Molecular beam epitaxy (MBE), ballistic jet. Non-epitaxial thin film deposition methods (ALD, magnetron deposition)
Practical activites within the subject	Not applicable