



## Subject card

Subject name and code	Growth of crystals and nanostructures, PG_00063342						
Field of study	Nanotechnology						
Date of commencement of studies	October 2025	Academic year of realisation of subject			2026/2027		
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	2	Language of instruction			Polish		
Semester of study	3	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Division of Nanomaterials Physics -> 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		prof. dr hab. inż. Wojciech Sadowski				
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	15.0	0.0	45
	E-learning hours included: 0.0						
	Additional information:  <a href="https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33618">https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33618</a>  The lecture will be delivered directly to the auditorium, with explanatory and supplementary commentary.  The project sessions will be preceded by a lecture covering the general concept and principles for selecting crystallization process design methods. Projects will be prepared in teams and presented directly by them.						
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	45		5.0		25.0	75
Subject objectives	Thermodynamic and kinetic aspects of the crystallization process (phase equilibrium, diffusion). Fundamentals of nanothermodynamics. The structure of real crystals - defects. Crystal growth methods (bulk crystals, nanocrystals and nanostructures). Crystal structure analysis methods.  PROJECT:  Basics of crystal growth process design. Selection of materials compounds, substances, and structural systems for crystallization. Selection of a given material crystallization method and its technological description. Project presentation.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_W05] has knowledge of inorganic and organic chemistry, physical chemistry and chemical thermodynamics.	The student is able to use the basics of thermodynamics to describe the synthesis process.	[SW3] Assessment of knowledge contained in written work and projects
	[K6_U02] can analyze and solve simple scientific and technical problems based on possessed knowledge, applying analytical, numerical, simulation and experimental methods.	The student is able to analyze and design the process of producing crystals	[SU4] Assessment of ability to use methods and tools
	[K6_W03] has systematic knowledge within the scope of all branches of general physics (mechanics and study of heat, electricity and magnetism, waves, optics, elements of modern physics).	The student is able to describe the basic processes of producing macro- and nano-sized crystals based on systematic knowledge of physics and chemistry.	[SW1] Assessment of factual knowledge
Subject contents	<p>Course content – lecture</p> <ol style="list-style-type: none"> <li>1. Thermodynamic and kinetic aspects of the crystallization process (phase equilibrium, diffusion).</li> <li>2. Fundamentals of nanothermodynamics. The specificity of the process of nanocrystallization.</li> <li>3. The structure of real crystals - defects.</li> <li>4. Crystal growth methods (bulk crystals, nanocrystals and nanostructures).</li> <li>5. Crystal structure analysis methods.</li> <li>6. Elements of self-assembly in the synthesis of nanocrystals.</li> <li>7. Nanoalloys - methods of preparation.</li> <li>8. Examples of crystallization of selected systems.</li> </ol> <p>PROJECT:  Basics of crystal growth process design.  Selection of materials compounds, substances, and structural systems (e.g., Si, C, GaGs, AlInSb, etc.) for crystallization.  Selection of a given material crystallization method and its technological description.  Analysis of the physicochemical properties and applications of the designed crystals.  Project presentation.</p>		
Prerequisites and co-requisites	Introduction to nanotechnology. Crystallography.		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Credit for the lecture content	50.0%	60.0%
	Preparation of crystal growth project and seminar presentation	100.0%	40.0%

Recommended reading	Basic literature	<p>1. I.V. Markov "Crystal Growth for beginners". World Scientific (2003, 2nd edition)</p> <p>2. D.T.J. Hurle, ed. "Handbook of Crystal Growth", vol. 1-a North Holland (1993)</p> <p>3. Nanocrystals Forming Mesoscopic Structures. Edited by Marie Paule Pileni 2005 WILEY-VCH.</p> <p><b>4. Handbook of Crystal Growth.</b> Vol. I-III. Editor-in-Chief and Volume Editor Tadao Nishinaga. 2015, 1993 Elsevier</p> <p><b>5. CONTROLLED GROWTH OF NANOMATERIALS.</b> Lide Zhang Xiaosheng Fang Changhui Ye. 2007 by World Scientific Publishing</p> <p><b>Nanocrystal.</b> Edited by Yoshitake Masuda. Published by InTech. Copyright © 2011 InTech</p> <p><b>Structure and Properties of Nanoalloys.</b> FRONTIERS OF NANOSCIENCE. Vol.10. Riccardo Ferrando. Series Editor: Richard E. Palmer. 2016 Elsevier</p>
	Supplementary literature	<p>1. A. A. Chernov. Modern Crystallography. III Crystal Growth. Springer-Verlag. Berlin Heidelberg New York Tokyo 1984</p> <p>2. Crystal Growth Edited by Brian R. Pamplin, Copyright 1980 Elsevier</p> <p><b>3. Nanocrystal.</b> Edited by Yoshitake Masuda. Published by InTech. Copyright © 2011 InTech</p> <p><b>4. Structure and Properties of Nanoalloys.</b> FRONTIERS OF NANOSCIENCE. Vol.10. Riccardo Ferrando. Series Editor: Richard E. Palmer. 2016 Elsevier</p>
	eResources addresses	
Example issues/ example questions/ tasks being completed	<p>Pursuant to point subject content.</p> <p>PROJECT:  Basics of crystal growth process design.  Selection of materials compounds, substances, and structural systems (e.g., Si, C, SiC, GaAs, GaP, GaN, AlInSb, etc.) for crystallization.  Selection of a given material crystallization method and its technological description (e.g. methods of growth of bulk crystals, thin films, island nanostructures, nanowires).  Analysis of the physicochemical properties and applications of the designed crystals.  Project presentation.</p>	
Practical activities within the subject	Not applicable	

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