GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Growth of crystals and nanostructures, PG_00063342		
Field of study	Wzrost kryształów i nanostruktur		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2025/2026
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 -> Wydziały Politechniki Gdańskiej		
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

eNauczanie source addresses:

Moodle ID: 2113 Wzrost kryształów i nanostruktur 2025
https://enauczanie.pg.edu.pl/2025/course/view.php?id=2113

Additional information:

https://enauczanie.pg.edu.pl/moodle/course/view.php?id=33618

Wykład prowadzony bezpośrednio audytoryjne z komentarzem wyjaśniającym i uzupełniającym.
Zajęcia projektowe poprzedzone w formie wykładowej omówieniem zasad projektowania procesów krystalizacyjnych.
Projekty przygotowywane będą w zespołach i bezpośrednio przez nie prezentowane.

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_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] Ocena wiedzy faktograficznej
[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] Ocena umiejętności korzystania z metod i narzędzi
[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] Ocena wiedzy zawartej w opracowaniu tekstowym i projektowym

Subject contents

1.Thermodynamic and kinetic aspects of the crystallization process (phase equilibrium, diffusion).

2. Fundamentals of nanothermodynamics. The specificity of the process of nanocrystallization.

3. The structure of real crystals - defects.

4. Crystal growth methods (bulk crystals, nanocrystals and nanostructures).

5 Crystal structure analysis methods.

6. Elements of self-assembly in the synthesis of nanocrystals.

7. Nanoalloys - methods of preparation.

8. Examples of crystallization of selected systems.

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.

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	I..I.V. Markov "Crystal Growth for beginners". World Scientific (2003, 2nd edition) 2. D.T.J. Hurle, ed. "Handbook of Crystal Growth", vol. 1-a North Holland (1993) 3. Nanocrystals Forming Mesoscopic Structures. Edited by Marie Paule Pileni 2005 WILE-VCH. **4. Handbook of Crystal Growth.** Vol. I-III. Editor-in-Chief and Volume Editor Tatau Nishinaga. 2015, 1993 Elsevier **5. CONTROLLED GROWTH OF NANOMATERIALS**. Lide Zhang Xiaosheng Fang Changhui Ye. 2007 by World Scientific Publishing **Nanocrystal.** Edited by Yoshitake Masuda. Published by InTech. Copyright © 2011 InTech **Structure and Properties of Nanoalloys.** FRONTIERS OF NANOSCIENCE. Vol.10. Riccardo Ferrando. Series Editor: Richard E. Palmer. 2016 Elsevier
	Supplementary literature	1. A. A. Chernov. Modern Crystallography. III Crystal Growth. Springer-Verlag. Berlin Heidelberg New York Tokyo 1984 2. Crystal Growth Edited by Brian R. Pamplin, Copyright 1980 Elseier **3. Nanocrystal.** Edited by Yoshitake Masuda. Published by InTech. Copyright © 2011 InTech **4. Structure and Properties of Nanoalloys.** FRONTIERS OF NANOSCIENCE. Vol.10. Riccardo Ferrando. Series Editor: Richard E. Palmer. 2016 Elsevier
	eResources addresses	
Example issues/ example questions/ tasks being completed	Pursuant to point subject content. 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.	
Practical activites within the subject	Not applicable	

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