GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Technologies of receiving nanomaterials, PG_00028253		
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	
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	4.0
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	15.0	0.0	0.0	45

E-learning hours included: 0.0

Additional information:

Lectures are presented in the form of presentations with commentary. Laboratory work is conducted in specialized laboratories at the Gdańsk University of Technology's Nanotechnology Center.

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	50.0	100

Subject objectives

Review of technologies used to produce and study nanomaterials and nanostructures.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U09] can design and conduct the process of producing nanostructured materials.	The student has the ability to design and implement processes for the production of nanostructured materials.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W07] has systematic knowledge of the physical and chemical principles of nanotechnology (methods of obtaining nanostructures, types of nanostructures, their properties, basic research methods).	The student has systematic knowledge of the physical and chemical foundations of nanotechnology - methods of obtaining nanostructures, types of nanostructures, their properties.	[SW1] Assessment of factual knowledge
[K6_W05] has knowledge of inorganic and organic chemistry, physical chemistry and chemical thermodynamics.	The student has knowledge of inorganic and organic chemistry, physical chemistry and chemical thermodynamics.	[SW1] Assessment of factual knowledge
[K6_U10] can forecast and assess potential negative biological and ecological effects of producing nanostructures on an industrial scale and their practical application.	The student is able to predict and assess the potential negative biological and ecological effects of the production of nanostructures on an industrial scale and their practical applications.	[SU4] Assessment of ability to use methods and tools
[K6_U06] can accurately present technological and scientific problems, related to the production and application of nanostructures, to specialists in related fields, and initiate and coordinate interdisciplinary cooperation.	The student is able to accurately present technological and scientific problems related to the production and applications of nanostructures.	[SU2] Assessment of ability to analyse information

<table>
<tr><td>Subject contents</td><td>Course content – lecture
Materials in modern technology. The scale of physical phenomena. Research tools used in nanotechnology. Methods of producing nanoparticles in the liquid, gas and solid phases. Methods of producing nanofibers. Carbon nanomaterials. Synthesis of fullerenes, carbon nanotubes, graphene. Methods of obtaining nanolayers. CVD vapor deposition methods, Vapor phase epitaxy (VPE) and its application to obtain nanostructures. Physical vapor deposition (PVD methods). Vacuum vaporization. Cathodic sputtering. Pulsed laser deposition (PLAD) technique. MBE molecular beam epitaxy. Sol-gel technology. Nanoceramics technology. Nanopowders and nanosinters. Mechanical synthesis. Forming and sintering of nanopowders. Nanometal technology. Rapid cooling and crystallization of amorphous materials. Nanocomposites technology. Methods of imaging the structure of nanomaterials using atomic force microscopy and electron microscopy. Application of the X-ray diffraction method to determine the size of crystallites and study the size distribution of nanocrystallites. Tomographic methods, nanoindentation. Theoretical, technical and economic limits of miniaturization. Examples of the use of nanotechnology in everyday life.

Topics covered in TON laboratories:

Introduction to chemical synthesis - basics of work in a chemical laboratory Preparation of bioextracts for nanoparticle synthesis. Biosynthesis of metallic nanoparticles. Characterization of metallic nanoparticles using UV-VIS spectroscopy. Characterization of the properties of metallic nanoparticles.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td></td></tr>
<tr><td>Assessment methods and criteria</td><td>
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<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Written exam - sets of 3 questions</td><td>50.0%</td><td>50.0%</td></tr>
<tr><td>Laboratory</td><td>100.0%</td><td>50.0%</td></tr>
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<tr><td>Recommended reading</td><td>
<table>
<tr><td>Basic literature</td><td>1. Michael F. Ashby, Paulo J. Ferreira and Daniel L. Schodek; Nanomaterials, Nanotechnologies and Design; Elsevier, 2009
2. Donglu Shi, Zizheng Guo and Nicholas Bedford; Nanomaterials and Devices; Elsevier, 2015
3. Bangwei Hang; Physical Fundamentals of Nanomaterials; Elsevier, 2018
4. Kelsall R.W., Haley J.W., Geghegan M (Eds.), Nanoscale Science and Technology, John Wiley & Sons Ltd</td></tr>
<tr><td>Supplementary literature</td><td>1. Dobrzański L.A.: Podstawy nauki o materiałach i metaloznawstwo. Materiały inżynierskie i podstawy projektowania materiałowego. WNT. 2002.
2. M.Ashby, H.Shercliff, D.Cebon, Inżynieria materiałowa, T1, T2, Wydawnictwo Galaktyka, Łódź, 2010
3. Blicharski M., Wstęp do inżynierii materiałowej, Wydawnictwo Naukowo Techniczne, Warszawa 2001</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
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<tr><td>Example issues/ example questions/ tasks being completed</td><td>1. Knowledge of basic concepts in the field of nanotechnology.
2. Knowledge of the principles of operation of devices and instruments used in nanotechnology.
3. Characteristics of the "top-down" and "bottom-up" methods
4. Ability to select nanostructured technology.
5. Knowledge of the basic properties of selected nanostructured materials.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
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