University of Gdańsk

Subject card

Subject name and code	Graduate study lecture - Nanomaterials: properties, synthesis, applications, PG_00082261		
Field of study	Chemistry		
Date of commencement of studies	October 2024	Academic year of realisation of subject	2024/2025
Education level	Master's studies	Subject group	Obligatory subject group in the field of study Optional subject group
Mode of study	full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	Polish
Semester of study	2	ECTS credits	3.0
Learning profile	academic	Assessment form	credit
Conducting unit	Laboratory of Photocatalysis -> Department of Environmental Technology -> Faculty of Chemistry -> Rector		
Name and surname of lecturer (lecturers)	Subject supervisor	dr inż. Beata Bajorowicz	
	Teachers		

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	30.0	0.0	0.0	0.0	0.0	30

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	30	5.0	40.0	75

Subject objectives

- To familiarise students with the preparation methods and properties of different types of nanomaterials.
- To familiarise students with methods of nanomaterial characterisation.
- To familiarise students with advanced applications of nanomaterials.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[CHEMMU2_U02] Critically assesses the results of conducted, performed observations and theoretical calculations and discusses errors.	The student assesses the usefulness of existing preparation methods and research and measurement methods used for the characterization of nanomaterials. The student critically analyzes published research results.	[SU2] presentation/project/paper/ report [SU4] test/exam - oral or written
[CHEMMU2_K01] Knows the limitations of her/his own knowledge; understands the need for further education and can inspire other people to do so.	The student understands the need continuous learning. Student demonstrates responsibility for timely delivery implementation of tasks.	[SK2] presentation/project/paper/ report [SK4] test/exam - oral or written
[CHEMMU2_W05] Has extended knowledge in the field of the specialisation studied.	The student has knowledge of physicochemical properties of various types nanomaterials. The student describes advanced methods of characterization and application of nanomaterials.	[SW4] test/exam - oral or written [SW2] presentation/project/paper/ report

Subject contents	Structure and classification of nanomaterials. Physical and chemical properties of nanomaterials. Methods of laboratory and industrial preparation of nanomaterials. Covalent organic frameworks and metal-organic frameworks. Janus type nanoparticles. Metallic and bimetallic nanoparticles. Organic nanoparticles. Physical and chemical methods for thin film deposition. Methods for characterisation and imaging of nanomaterials. Synthesis methods of single crystals. Semiconductor materials technology. Application of ionic liquids to obtain nanomaterials. Carbon nanostructures: nanotubes and graphene. Quantum dot technology. Nanomaterials in catalysis. Advanced applications of nanomaterials. Hazards associated with the use of nanomaterials.	
Prerequisites and co-requisites	Basics of general, inorganic, organic and analytical chemistry	
Assessment methods and criteria		

Subject passing criteria	Passing threshold	Percentage of the final grade
	51.0%	20.0%
	51.0%	80.0%

Recommended reading	Basic literature	1. K. Żelechowska, Nanotechnologia w praktyce, PWN, Warszawa, 2016 2. K. J. Kurzydłowski, M. Lewandowska, W. Łojkowski, Świat nanocząstek, PWN, Warszawa, 2022 3. L. Cademartiri, G. A. Ozin, Nanochemia: podstawowe koncepcje, PWN, Warszawa, 2011 4. K.J. Kurzydłowski, M. Lewandowska, Nanomateriały inżynierskie, konstrukcyjne i funkcjonalne, PWN, Warszawa, 2020 5. R.W. Kelsall, I.W. Hamley, M. Geoghegan, Nanotechnologie, PWN, Warszawa, 2012 6. B. Wang, Hybrid metal-organic framework and covalent organic framework polymers, Royal Society of Chemistry, London, UK 2022
	Supplementary literature	Research articles recommended by lecturers.
	eResources addresses	
Example issues/ example questions/ tasks being completed	1. The most important techniques for the characterization of nanomaterials. 2. Properties and applications of covalent organic frameworks and organometallic frameworks. 3. Structure and properties of graphene. 4. Application of nanomaterials in catalysis. 5. Characteristics of materials with perovskite structure. 6. Nanomaterials used for energy storage systems.	
Work placement	Not applicable	

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