GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00058940		
Field of study	Nanotechnology		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2023/2024
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 no
Semester of study	4	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Maria Gazda	
	Teachers	Daniel Jaworski prof. dr hab. inż. Maria Gazda	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	30.0	0.0	0.0	45

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	45	5.0	50.0	100

Subject objectives

Learning the properties and methods of producing selected groups of functional materials and nanomaterials

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_U10	Can predict and assess the potential effects of producing and using functional nanomaterials on an industrial scale.	[SU2] Assessment of ability to analyse information
K6_W06	Has basic knowledge of the science of functional materials	[SW1] Assessment of factual knowledge
K6_U06	Is able to present in a simple and accurate way technological and scientific problems related to the production and applications of functional nanomaterials and to initiate and coordinate cooperation	[SU1] Assessment of task fulfilment
K6_W07	Has systematic knowledge of the physical and chemical basis of methods for obtaining functional nanomaterials, their groups and properties.	[SW1] Assessment of factual knowledge
K6_U09	Has the ability to design and produce selected functional nanomaterials	[SU1] Assessment of task fulfilment

Subject contents

Introduction: nanomaterials, nanostructures;Nanomaterials and nanostructures with special functions resulting from the properties of:electrical;optical;magnetic;other;

Laboratory:

The laboratory consists of three multi-stage experiments: synthesis and testing of the high-temperature superconductor YBCO, production and testing of a Gretzel (dye) cell and precipitation of selected metal oxide nanoparticles.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">no</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>lab assesement</td><td>55.0%</td><td>40.0%</td></tr>
<tr><td>test</td><td>55.0%</td><td>60.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">Any book about nanotechnology, e.g. Introduction to nanoscience, Lindsay</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">Scientific literature</td></tr>
<tr><td>eResources addresses</td><td colspan="2">Podstawowe
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27780 - Materials for the lecture on Functional Nanomaterials
Adresy na platformie eNauczanie:
Nanomateriały funkcjonalne - Moodle ID: 27780
https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27780</td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">1. The best example of functional nanostructures are elements used to record information. Physical phenomena related to nano-size that are important in this field are giant magnetoresistance and tunnel magnetoresistance. Describe them briefly and explain their relationship to the information recorded. 2. List the defects present in nanomaterials. How does size affect the concentration of individual defects (with a short explanation)? 3. How does size affect the elastic properties, strength, melting point and heat capacity of materials (with a brief explanation)? 4. Explain why:The heat capacity of a nanomaterial is greater than that of its micro-counterpartThe concentration of dislocations in a nanometal is lower than in its micro-counterpartThe optical properties of a nanometal are different than those of its micro-counterpart.5. Can a mirror be made in any other way than applying a layer of metal to glass? 6. Name 2 different examples of metamaterials and describe one of them. 7. The lectures discussed "functional materials and nanomaterials" containing Cu/Si/ /some other. List them and describe the properties of one of them. 8. The lectures discussed "functional materials and nanomaterials" in the form of oxides. List them and describe the properties of one of them. 9. What properties should the superconductor from which the winding of an electromagnet generating a magnetic field of B = 15 T be made of?</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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