GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Functional Materials , PG_00061901		
Field of study	Materials Engineering		
Date of commencement of studies	October 2023	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	1	Language of instruction	Polish no
Semester of study	2	ECTS credits	4.0
Learning profile	general academic profile	Assessment form	exam
Conducting unit	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. Maria Gazda	
	Teachers	dr inż. Marek Augustyniak	
		prof. dr hab. inż. Maria Gazda	

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	0.0	0.0	15.0	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 basics of manufacturing, shaping, properties and applications of functional materials with special electrical, optical and magnetic properties

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U03] Can critically analyze and evaluate the functioning – particularly in the context of materials engineering –existing technical solutions, particularly equipment, objects, systems, processes.	is able to critically analyze the functioning of certain electronic, optical or electrochemical components	[SU3] Assessment of ability to use knowledge gained from the subject
	[K6_U09] Has the ability to prepare oral presentations in Polish and in a foreign language, concerning detailed issues, using fundamental theoretical approaches, and diverse sources.	has the ability to prepare oral presentations in Polish regarding functional materials	[SU5] Assessment of ability to present the results of task
	[K6_W03] Has knowledge of materials science and can relate the properties of materials with their structure and composition, knows the theoretical description of phenomena occurring in materials subjected to external factors.	has knowledge in the field of functional materials allowing to link the properties of materials with their structure and composition, knows the description of phenomena such as current flow, light absorption, etc.	[SW1] Assessment of factual knowledge
	[K6_U07] Can obtain information from literature and other properly selected sources, also in English or other foreign language used for international communication in materials engineering.	is able to obtain information about functional materials from literature, databases and other appropriately selected sources, also in English	[SU1] Assessment of task fulfilment

Subject contents	IntroductionRevision: structure, defects, bonds and properties, thermodynamic basis;Diffusion;Reactions in the solid phase.Functional materials thanks to their electrical properties:Electronic and electrotechnical materials: metals;Electronic and electrotechnical materials: semiconductors;Superconductors;Dielectrics;Functional materials thanks to their optical properties:Where does color, (non)transparency, (non)reflection, polarization of light come from?glowing?Functional materials thanks to their thermal properties:Where does heat (non)conduction come from?Functional materials thanks to their magnetic properties.Production and shaping of functional materials:Production of single crystals;Thin layers;Lithography, etching and other semiconductor technologies;Integrated circuit, connections between different materials;
	Seminar:Discussion in groups about functional materials, practical exercise in recognizing materials, searching for information about materials, their applications, properties, etc.; Summary consisting of preparing and delivering a presentation

Prerequisites and co-requisites	no

Assessment methods and criteria			
	Subject passing criteria	Passing threshold	Percentage of the final grade
	written and oral presentation	55.0%	30.0%
	written test	55.0%	70.0%

Recommended reading	Basic literature	Wyniki tłumaczeniaTłumaczenie Any materials science textbook, e.g. Introduction to Materials Engineering - M. Blicharski
	Supplementary literature	any relevant literature
	eResources addresses	Podstawowe
		https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27783 - course materials "Functional Materials"
		Adresy na platformie eNauczanie:
		Materiały funkcjonalne - Moodle ID: 27783 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=27783

Example issues/ example questions/ tasks being completed	Mark the true sentences (there can be more than 1).the rate of diffusion increases with increasing temperature;the rate of diffusion is proportional to temperature;the rate of diffusion depends on the temperature and on the type and concentration of structural defects;solid-state diffusion may damage certain materials or devices.The figure shows the dependence of the nucleation rate and crystal growth on temperature when a solid is obtained by cooling a molten liquid. Based on the drawing, write and justify whether the material that will be created will be amorphous or crystalline.List the lithography methods that use electromagnetic radiation. Describe the one you consider the most modern.What properties should the superconductor from which the winding of an electromagnet generating a magnetic field of B = 15 T be made of?You can choose from: copper, gold, nickel-chromium alloy, niobium-titanium alloy, carbon, conductive metal oxides, YBCO, SiC, zirconium oxide, SiO2, gallium arsenide and doped silicon (n and p). Which of the above materials can be used (and why?) to produce:a resistor with a resistance of several k,transistor,heating elements for a furnace generating a temperature of 1300°C.
Work placement	Not applicable

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