



Subject card

Subject name and code	Advanced material technologies, PG_00072354						
Field of study	Technologies for Industry 5.0						
Date of commencement of studies	October 2024		Academic year of realisation of subject		2026/2027		
Education level	first-cycle studies		Subject group		Optional subject group 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	3		Language of instruction		Polish		
Semester of study	5		ECTS credits		4.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Division of Ceramics -> 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		dr hab. inż. Aleksandra Mielewczyk-Gryń				
	Teachers		dr inż. Daniel Jaworski dr hab. inż. Aleksandra Mielewczyk-Gryń				
Lesson types	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						
	eNauczanie source addresses: Moodle ID: 8314 Zaawansowane technologie materiałowe 2026/2027 https://enauczanie.pg.edu.pl/2025/course/view.php?id=8314						
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		3.0		52.0	100
Subject objectives	The aim of the course is to familiarize students with modern and emerging materials technologies used within the Industry 5.0 framework, with particular emphasis on smart, sustainable, and functional materials, as well as solutions enabling the integration of digital, robotic, and biological technologies. Students gain knowledge of the properties, manufacturing processes, and applications of advanced materials and develop competencies in assessing their suitability for next-generation production systems.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[K6_U03] has the ability to plan, prepare and carry out engineering activities using practical knowledge and understanding of the specificity of materials, devices and tools, processes and technologies, and prepare a substantive report	Is able to plan, prepare, and carry out engineering activities related to the selection, manufacturing, and application of modern materials, using knowledge of their properties and the specific characteristics of processes, technologies, equipment, and tools, as well as to analyze the obtained results and prepare a technical report.	[SU1] Assessment of task fulfilment [SU3] Assessment of ability to use knowledge gained from the subject [SU5] Assessment of ability to present the results of task
	[K6_K02] makes decisions independently, carries out a critical assessment of own actions and actions of managed teams, is ready to make decisions and accept responsibility for the consequences of these actions	Independently makes decisions regarding the selection and application of modern materials technologies, critically evaluates proposed solutions as well as their own and the team's activities, taking into account technological, environmental, and social aspects, and is prepared to take responsibility for the consequences of the decisions made.	[SK1] Assessment of group work skills [SK3] Assessment of ability to organize work
	[K6_W03] demonstrates knowledge on materials used in industrial technologies, their structure and fabrication, knows the principles of conducting research, analyzing it and creating technical documentation	Demonstrates knowledge of modern materials used in industrial technologies, including their structure, properties, manufacturing methods, and applications. Understands the principles of planning and conducting materials research.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects

Subject contents	Course content – lecture 1. Smart materials – piezoelectric materials, shape memory alloys (SMA), photoresponsive, electroactive, and self-healing materials. 2. Nanomaterials and nanostructuring – CNTs, graphene, nanocomposites. 3. Composite materials – structure, properties, and manufacturing technologies. 4. Biodegradable, bioinspired, and biocompatible materials. 5. Surface modification – PVD, ALD, laser and plasma methods. 6. Sustainable materials technologies – LCA, recycling, material recovery, and green materials. 7. Materials of the future. Course content – laboratory Materials Synthesis 1. Material Selection and Literature Review • selection of the material and synthesis method based on available sources, • brief literature review of material properties and processing parameters. 2. Experimental Design • definition of the objective and the expected form of the material, • determination of synthesis parameters (e.g., reagent concentrations, temperature, time), • development of the experimental procedure and safety guidelines. 3. Synthesis • implementation of the synthesis process according to the experimental design and control of process parameters, • isolation and purification of the obtained material, • documentation of the process and results. 4. Material Characterization • basic morphological and structural characterization, • evaluation of selected functional properties, • comparison of the obtained results with literature data.
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	5. Data Analysis and Reporting • analysis and interpretation of the obtained results, • assessment of whether the properties of the synthesized material meet the initial assumptions, • preparation of documentation and a final report. • presentation of the results											
Prerequisites and co-requisites												
Assessment methods and criteria	<table><tr><td>Subject passing criteria</td><td>Passing threshold</td><td>Percentage of the final grade</td></tr><tr><td>exam</td><td>50.0%</td><td>70.0%</td></tr><tr><td>laboratory</td><td>50.0%</td><td>30.0%</td></tr></table>	Subject passing criteria	Passing threshold	Percentage of the final grade	exam	50.0%	70.0%	laboratory	50.0%	30.0%		
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Example issues/ example questions/ tasks being completed	• Give an example of a ceramic material manufacturing method and briefly describe its main stages. • Identify nanomaterials that are currently of greatest importance in industrial applications and provide examples of their uses. • Explain what Life Cycle Assessment (LCA) is and why it plays an important role in materials science and engineering.											
Practical activities within the subject	Not applicable											

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