GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00059047		
Field of study	Materials Engineering, Materials Engineering, Materials Engineering		
Date of commencement of studies	October 2022	Academic year of realisation of subject	2024/2025
Education level	first-cycle studies	Subject group	Obligatory subject group 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	6	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Ceramics -> Institute of Nanotechnology and Materials Engineering -> Faculty of Applied Physics and Mathematics		
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Aleksandra Mielewczyk-Gryń	
	Teachers		

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	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	2.0	18.0	50

Subject objectives

The aim of the **Engineering Ceramics** course is to familiarize students with the properties, structure, manufacturing methods, and applications of ceramic materials in engineering. Students gain knowledge about the classification of technical ceramics, their behavior under various operating conditions, and the influence of chemical composition and microstructure on mechanical, thermal, electrical, and chemical properties. Additionally, the course covers topics related to modern ceramic processing technologies, such as sintering, forming, and coating, as well as analyzing innovative applications of ceramics in industry, medicine, and electronics.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W07	Has in-depth knowledge of selected aspects of materials science.	[SW1] Assessment of factual knowledge
K6_U07	Is able to acquire information from literature, databases, and appropriately selected sources, also in English or another foreign language recognized as an international means of communication in the field of materials engineering.	[SU2] Assessment of ability to analyse information
K6_W03	Has fundamental knowledge of materials science and can relate material properties to their structure and composition. Understands the theoretical aspects of phenomena occurring in materials exposed to external factors.	[SW1] Assessment of factual knowledge

Subject contents	**Introduction to Engineering Ceramics** **Definition and Classification of Ceramic Materials** • Fundamental properties of technical ceramics • Applications of ceramics in various industries **Structure and Composition of Ceramic Materials** • Chemical bonding in ceramics • Microstructure and phases in ceramic materials • Influence of structure on mechanical, thermal, and electrical properties **Manufacturing Methods of Ceramic Materials** • Ceramic forming: pressing, injection molding, casting • Sintering and ceramic synthesis processes • Coating technologies and ceramic composites **Properties of Ceramic Materials** • Mechanical properties: hardness, strength, wear resistance • Thermal properties and resistance to thermal shocks • Electrical and optical properties of ceramics **Functional Ceramics and Advanced Ceramic Materials** • Electroceramics and piezoelectric ceramics • Refractory ceramics and bioceramics • Nanoceramics and modern applications **Applications of Ceramics in Engineering and Industry** • Ceramics in aerospace, automotive, and medical fields • Ceramic materials in electronics and energy sectors • Future of engineering ceramics and development trends **Testing and Analysis Methods for Ceramic Materials** • Microscopic and X-ray techniques • Mechanical and thermal testing methods • Analysis of electrical and chemical properties of ceramics
Prerequisites and co-requisites	
Assessment methods and criteria	

Subject passing criteria	Passing threshold	Percentage of the final grade
test	50.0%	100.0%

Recommended reading	
Basic literature	CeramicMaterials Processes, Properties and Applicationsedited by Philippe Boch and Jean-Claude Nièpce Hermès Science Publications
Supplementary literature	Fundamentals of Modern Manufacturing: Materials, Processes and Systems John Wiley & Sons
eResources addresses	Adresy na platformie eNauczanie:

Example issues/ example questions/ tasks being completed	**Definition and Classification of Ceramic Materials** • What characteristics define ceramic materials and what are their main types? • List and describe different classes of technical ceramics, providing examples of their applications. **Structure and Composition of Ceramic Materials** • Explain the types of chemical bonds present in ceramic materials and how they influence their properties. • Describe the impact of ceramic microstructure on its mechanical and thermal properties. **Manufacturing Methods of Ceramic Materials** • Describe the ceramic forming processes of pressing, injection molding, and casting. What are the advantages and disadvantages of these methods? • Explain the ceramic sintering process and its significance for obtaining the desired material properties. **Properties of Ceramic Materials** • What mechanical properties are characteristic of ceramics? Provide examples of high-hardness ceramics. • Discuss the thermal properties of ceramics, including resistance to thermal shock and their use in extreme conditions. **Functional Ceramics and Advanced Ceramic Materials** • What is piezoelectric ceramics and in which fields is it used? • Discuss the applications of nanoceramics in modern technologies. **Applications of Ceramics in Engineering and Industry** • How is ceramics used in the automotive and aerospace industries? • What are the advantages of using ceramics in medicine, particularly in implants and prosthetics? **Testing and Analysis Methods for Ceramic Materials** • What microscopic techniques are used to analyze the microstructure of ceramic materials? • Describe the X-ray method for analyzing ceramic materials and its application in structural research. **Modern Technologies in Engineering Ceramics** • What technological innovations have impacted the development of engineering ceramics in recent years? • How do ceramic composites differ from traditional ceramic materials and in which fields are they used?
Work placement	Not applicable

Document generated electronically. Does not require a seal or signature.