GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Glasses and glass-nanoceramic composites, PG_00071208						
Field of study	Nanotechnology, Nanotechnology						
Date of commencement of studies	February 2027		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group		Specialty 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	1		Language of instruction		English		
Semester of study	1		ECTS credits		3.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Division of Electrochemistry and Surface Physical Chemistry -> 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. Natalia Wójcik				
	Teachers						
Lesson types	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	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		2.0		28.0	75
Subject objectives	The aim of this course is to introduce students to the fundamentals of the physical chemistry of glasses and glass-nanoceramic composites, including their structure, synthesis and processing methods, as well as the relationships between chemical composition, structure, and functional properties. The course is intended to develop students ability to design modern glass and glass-ceramic materials with tailored properties and to interpret experimental data obtained using selected structural and physical characterization techniques.						

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] has knowledge of current development trends and the latest discoveries in the fields of physics, chemistry, technology, and applications of nanostructures	The student knows the main applications of modern amorphous materials and glass nanocomposites.	[SW1] Assessment of factual knowledge
[K7_U04] is able to formulate hypotheses, plan and conduct experimental research, critically analyze results, verify hypotheses, draw conclusions, and formulate well-founded opinions within nanotechnology and related physical and natural sciences. Recognizes economic and non-technical aspects of the activities performed	The student melts glass, conducts in vitro solubility tests, and analyzes the results. Prepares a report of the results and is able to critically evaluate them.	[SU2] Assessment of ability to analyse information [SU4] Assessment of ability to use methods and tools [SU5] Assessment of ability to present the results of task
[K7_W07] has extended knowledge of the effects of using nanostructures in biological, environmental, social, economic, and legal dimensions, as well as in a broad non-technical context. Also has extended knowledge of the basics of entrepreneurship, quality management, or safety related to the application of nanomaterials	Student possesses extended knowledge of the environmental, biological, and socio-economic impacts associated with the use of glass-ceramic nanocomposites, and is familiar with the principles of safety and quality related to their design and application.	[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation
[K7_W04] has theoretical and practical knowledge of physical and chemical experimental methods in nanotechnology and understands the principles of their application in processes occurring throughout the life cycle of technical systems	Student possesses theoretical and practical knowledge of physical and chemical experimental methods used in the investigation of special glasses and glass-ceramic nanocomposites, and understands the principles governing their selection and application at various stages of the material life cycle.	[SW1] Assessment of factual knowledge

Subject contents

Course content – lecture

- Glasses around us technological and societal significance
- Theories of the structure of amorphous materials
- Methods for the fabrication of special glasses and glass-ceramic nanocomposites
- Physical and chemical experimental methods in glass research
- Fundamental properties of glasses and glass-ceramic nanocomposites
- Special glasses and functional glass-ceramic nanocomposites
- Life cycle of glass-ceramic materials and aspects of safety and quality

Course content – laboratory

- Designing the composition of the bioactive glass, melting, and conducting structural studies.
- Planning and conducting an in vitro dissolution test.
- Analysis of the obtained results.
- Preparing a report.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
laboratory report	50.0%	50.0%
lecture test and presentation	50.0%	50.0%

Recommended reading

Basic literature	• Shelby, J. E. (2005). *Introduction to Glass Science and Technology* . Cambridge: The Royal Society of Chemistry. • Zarzycki, J. (Ed.). (1991). *Materials Science and Technology: Glasses and Amorphous Materials* (Vol. 9). Weinheim: VCH Publishers. • *Glass Nanocomposites: Synthesis, Properties and Applications,* Edited by Basudeb Karmakar, Klaus Rademann, Andrey L. Stepanov (William Andrew / Elsevier, 2016). ISBN: 978-0-323-39309-6
Supplementary literature	n/d
eResources addresses	

Example issues/ example questions/ tasks being completed	• Analysis of the relationship between structure and the physical and chemical properties of glasses. • Selection of appropriate experimental methods for the characterization of glass-ceramic nanocomposites at different stages of their fabrication and application. • Evaluation of the influence of nanostructure on the functional properties of glass-ceramic materials. • Mechanisms of bioactivity of bioactive glasses and the kinetics of hydroxyapatite layer formation under in vitro conditions. • Influence of chemical composition and nanostructure of bioactive glasses on degradation rate, ion release, and biological response.
Practical activites within the subject	Not applicable

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