GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	, PG_00065850		
Field of study	Materials Engineering		
Date of commencement of studies	October 2025	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	2	Language of instruction	Polish
Semester of study	3	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	dr hab. inż. Natalia Wójcik	

Lesson types

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	15.0	0.0	15.0	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	5.0	40.0	75

Subject objectives

The aim of the course is to familiarize students with methods of modifying the properties of glassy materials through changes in composition, structure, manufacturing techniques, and heat treatment. Students will explore special properties of glasses, such as ionic and electronic conductivity, ferroelectricity, ferromagnetism, and chemical resistance, as well as their applications in renewable energy, environmental protection, and tissue engineering. In the laboratory part, students design and synthesize low-melting glasses doped with alkali or transition metal ions, investigate their properties, and prepare analytical reports based on the results.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_U04] Can undertake a detailed analysis of the obtained results and develop a technical report or presentation, also in English.	The student is able to analyze the results of tests of glass properties and draw conclusions based on them. Is able to develop data in the form of a technical report or presentation.	[SU2] Assessment of ability to analyse information
[K7_U03] Can formulate a research hypothesis, design an experiment needed to prove it and use properly selected measuring and laboratory methods.	The student is able to formulate a hypothesis regarding the properties of glass materials, design an appropriate experiment and conduct it using synthesis techniques, heat treatment and properties measurement. Is able to select and apply appropriate laboratory methods to analyze the obtained results.	[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject
[K7_W01] Has extended knowledge of the fields of science and scientific disciplines relevant to materials engineering, and their historical development and importance for the progress of exact and natural sciences, knowledge of the world and evolution of humanity.	The student has extended knowledge of the properties and modifications of glass materials and their applications in modern technologies. Understands the importance of glasses in the context of the development of natural sciences and materials engineering, especially in the areas of renewable energy and biomaterials.	[SW1] Assessment of factual knowledge

<table>
<tr><td>Subject contents</td><td>Course content – lecture

Lecture:

• Methods of modifying the properties of glassy materials by changing the manufacturing technique, composition, structure and heat treatment;
• Special properties of glassy materials: high electrical conductivity, ferroelectricity, ferromagnetism, chemical resistance, thermal resistance, biodegradability, recyclability;
• Application of glassy materials: in renewable energy, including photovoltaic panels, new generation batteries, environmental protection, nuclear energy, tissue engineering.

Laboratory

• Design of low-melting, silicate-borate/phosphate glass compositions doped with high content of alkali ions
• Glass melting
• Glass processing
• Study of different properties
• Results analysis and report preparation</td></tr>
<tr><td>Prerequisites and co-requisites</td><td>Basic knowledge of glass production and characteristic properties required.</td></tr>
<tr><td>Assessment methods and criteria</td><td><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>lab report</td><td>50.0%</td><td>50.0%</td></tr><tr><td>lecture written test</td><td>50.0%</td><td>50.0%</td></tr></table></td></tr>
<tr><td>Recommended reading</td><td><table><tr><td>Basic literature</td><td>• Shelby, J.E., Introduction to Glass Science and Technology, Royal Society of Chemistry, 2005.
• Varshneya, A.K., Mauro, J.C., Fundamentals of Inorganic Glasses, Elsevier, 2019.
• Bansal, N.P., Doremus, R.H., Handbook of Glass Properties, Academic Press, 1986.</td></tr><tr><td>Supplementary literature</td><td>n/d</td></tr><tr><td>eResources addresses</td><td></td></tr></table></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td>• How does changing the chemical composition of glass affect its physical and chemical properties?
• How does ionic conductivity differ from electronic conductivity in glass materials?
• Designing the composition of low-melting borate-phosphate glass with a high ion content.
• Carrying out the glass melting process in laboratory conditions.</td></tr>
<tr><td>Practical activites within the subject</td><td>Not applicable</td></tr>
</table>

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