GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Nanostructures in glasses and amorphous materials, PG_00031637		
Field of study	Nanotechnology		
Date of commencement of studies	October 2023	Academic year of realisation of subject	2025/2026
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	6	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Nanomaterials Physics -> 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 inż. Leszek Wicikowski	
	Teachers	dr inż. Leszek Wicikowski	

Lesson types

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 main aim is to present the fundamental knowledge and achievements in preparation of different nanostructures in glasses and amprphous materials and also to indicate their application in materials technology.

Learning outcomes

Course outcome	Subject outcome	Method of verification
K6_W06	The student is able to describe the structural differences between crystalline and amorphous materials. Is able to indicate the basic research methods used to characterize the structure of glasses and amorphous materials. Knows the basic parameters used to characterize the glassy state. Knows the generally accepted theories related to the glassy state.	[SW1] Assessment of factual knowledge [SW3] Assessment of knowledge contained in written work and projects
K6_U06	The student can provide methods of producing nanostructures in amorphous materials using the knowledge of physics, chemistry and material engineering	[SU5] Assessment of ability to present the results of task [SU3] Assessment of ability to use knowledge gained from the subject
K6_W07	The student knows the importance of nanostructures in defining the properties of materials. Can identify research tools for their characterization.	[SW3] Assessment of knowledge contained in written work and projects

Subject contents

Course content – lecture
Glassy state of matter. Glass transition. Glass formation criteria. Short range order. Phase separation. Processes of crystallization and nano-crystallization.Classification of inorganic oxide glasses. Special glasses: chalcogenide and metallic glasses. Preparation of glasses and amorphous materials. Aerogels and sol-gel films. Physical properties of glasses. Amorphous semiconductors (amorphous silicon, mobility gap, defects). Optical and electrical properties of glasses containing metallic and semiconducting nanostructures. Optical nonlinearity in glasses. Application of amorphous materials in electronics and opto-electronics.

Prerequisites and co-requisites

Fundamental knowledge in solid state physics and quantum physics

<table>
<tr><td>Assessment methods and criteria</td><td colspan="2"><table>
<tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr>
<tr><td>Essay</td><td>100.0%</td><td>50.0%</td></tr>
<tr><td>Activity during lectures</td><td>50.0%</td><td>50.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td>1. R. Zallen, The physics of amorphous solids, Wiley NY, 1983

2. Fuxi Gan and Lei Xu, Photonic Glasses, World Scientific, 2006

3. S.R. Elliott, Physics of amorphous materials, Wiley,1990

4. J. Zarzycki, Glasses and the vitreous state, Cambridge University Press,1991

5. Arun K. Varshneya, Fundamentals of Inorganic Glasses</td></tr>
<tr><td>Supplementary literature</td><td>Scientific publications concerning topics of seminars</td></tr>
<tr><td>eResources addresses</td><td></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="2">Glassy state of matter. Glass transition. Glass formation criteria. Short range order. Phase separation. Processes of crystallization and nano-crystallization.Classification of inorganic oxide glasses. Special glasses: chalcogenide and metallic glasses. Preparation of glasses and amorphous materials. Aerogels and sol-gel films. Ionic and electronic conductivity in glasses. Thermal properties of glasses and aerogels. Electrical properties of amorphous semiconductors (amorphous silicon, mobility gap, defects). Optical and electrical properties of glasses containing metallic and semiconducting nanostructures. Optical nonlinearity in glasses.</td></tr>
<tr><td>Practical activites within the subject</td><td colspan="2">Not applicable</td></tr>
</table>

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