



Subject card

Subject name and code	, PG_00059074											
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		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		3.0								
Learning profile	general academic profile	Assessment form		exam								
Conducting unit	Zakład fizyki nanomateriałów -> Instytut Nanotechnologii i Inżynierii Materiałowej -> Faculty of Applied Physics and Mathematics											
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Leszek Wicikowski									
	Teachers											
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM					
	Number of study hours	15.0	0.0	0.0	0.0	15.0	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 main aim is to present the fundamental of the glassy state including structure, methods of preparation and application of amorphous and glassy materials											
Learning outcomes	Course outcome		Subject outcome			Method of verification						
	K6_U07		The student can use scientific articles, can use existing databases. He is fluent in English and the terminology related to glasses and amorphous materials.			[SU3] Assessment of ability to use knowledge gained from the subject [SU4] Assessment of ability to use methods and tools						
	K6_W07		The student uses theoretical knowledge about glasses and amorphous materials freely. Can define the methods of their production and research methods used to characterize these materials			[SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation						
	K6_U09		The student can prepare an oral presentation in a seminar and a report on project work based on the available literature. Using this knowledge, he can find applications of amorphous materials and describe its properties			[SU5] Assessment of ability to present the results of task						
	K6_K01		Based on scientific papers, the student can prepare a written article on a given topic regarding nanostructural modifications of glasses and amorphous materials. The student can critically evaluate information. He can use the literature and knowledge of experts			[SK5] Assessment of ability to solve problems that arise in practice						

Subject contents	Charakterystyczne cechy stanu szklistego. Temperatura transformacji ciecz-szkło. Lepkość .Procesy krystalizacji, separacja faz.Metody wytwarzanie materiałów amorficznych: szkła, szkło-ceramika, cienkie warstwy, metoda zol-żel. Szkła w naturze. Podstawowe technologie. Układy szkłotwórcze ich struktura i właściwości. Model sieci nieuporządkowanej. Funkcja radialna rozkładu. Kryteria szkłotwórczości Zachariasena. Tlenki szkłotwórcze, tlenki pośrednie, modyfikatory.Szkła krzemianowe metody wytwarzania, struktura, światłowody. Szkła sodowo-wapniowe, borokrzemianowe, krzemianowo ołowiowe, glinokrzemianowe. Wpływ tlenków modyfikujących na strukturę i właściwości szkiet. Szkła boranowe struktura najbliższego otoczenia boru, wpływ tlenków alkalicznych, podstawowe cechy i własności, Szkła fosforanowe i tellurowe specyfika struktury tych szkiet, podstawowe cechy i właściwości.				
Prerequisites and co-requisites	Fundamental knowledge in physics and chemistry				
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade		
	Seminar	50.0%	50.0%		
	Colloquim	50.0%	50.0%		
Recommended reading	Basic literature	R. Zallen, Fizyka Ciał Amorficznych PWN, 19942. A. Szwedowski, R. Romaniuk, Szkło optyczne i fotoniczne Wyd. NT 2009 R. H. Doremus Glass Science, Wiley 1973 J.E. Shelby, Introduction the glass science and technology, RSC 2005 A.K. Varshneya. Fundamentals of inorganic glasses, Academic Press			
	Supplementary literature	Additional materials (electronic version) from lecturer			
	eResources addresses	Adresy na platformie eNauczanie:			
Example issues/example questions/tasks being completed	Glassy state of matter. Glass transition. Viscosity. Glass formation criteria. Random network. Radial distribution function. Glassforming oxides and modifiers. Structure of glass. Classification of inorganic oxide glasses. Crystallization processes and phase separation in glasses. Glass-ceramics Glass technology. Typical silicate, borate, phosphate and tellurite systems				
Work placement	Not applicable				