



Subject card

Subject name and code	Crystallography, PG_00061905						
Field of study	Materials Engineering						
Date of commencement of studies	October 2025	Academic year of realisation of subject				2026/2027	
Education level	first-cycle studies	Subject group				Obligatory subject group in the field of study 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	Institute Of Nanotechnology And Materials Engineering -> Faculty Of Applied Physics And Mathematics -> Wydziały Politechniki Gdańskiej						
Name and surname of lecturer (lecturers)	Subject supervisor		prof. dr hab. inż. Maria Gazda				
	Teachers		prof. dr hab. inż. Maria Gazda				
Lesson types and methods of instruction	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 the basic concepts of crystallography, such as crystal lattice, unit cell, symmetry, packing density, structural defects, etc., and to link them with the chemical composition and properties of materials. The aim of the course is also to learn and acquire skills in the field of experimental methods of crystallography.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K6_W04] Knows selected aspects of construction and operation of scientific equipment in materials engineering.		Knows the structure and operation of scales, optical microscopes and X-ray diffractometers		[SW3] Assessment of knowledge contained in written work and projects		
	[K6_U01] Can properly use selected analytical, simulation and experimental methods, as well as devices for measuring the fundamental properties of materials and technological processes.		Is able to use methods to develop X-ray diffractometry results and can use various tools to visualize crystal structures.		[SU1] Assessment of task fulfilment		
	[K6_W02] has knowledge of physics and chemistry, useful for formulating and solving simple problems within the scope of materials science		Has knowledge of physics and chemistry enabling simple crystallographic calculations		[SW1] Assessment of factual knowledge		
	[K6_U02] Can operate typical laboratory equipment and analyze material tests		is able to operate a scale, an optical microscope and, under supervision, an X-ray diffractometer		[SU4] Assessment of ability to use methods and tools		

Subject contents	Lecture: Introduction: the subject of crystallography, history, crystalline and amorphous materials;Description of three-dimensional spatial networks, Bravais network and atomic basis. Crystallographic axes. Symbols for positions, directions and planes. Crystallographic patterns. Crystal symmetry (closed and open operations). Symmetry groups. Examples of real crystal structures. Their characteristic features and some properties (packing density, coordination number, coordination polyhedron).Inverse network: definition, physical interpretation. Methods of examining the structure of crystals. X-ray diffractometry.Structure defects, types and their impact on the properties of crystalline bodies.How crystals are formed: crystallization, crystal morphology.Physical properties of crystals: density, anisotropy properties, e.g. optical birefringence. Lab: The laboratory includes exercises: producing crystals from solution; building 3- and 2-dimensional models of periodic structures; symmetry study; determining packing density; density measurement; tests using an X-ray diffractometer; examination of two-dimensional structures using optical diffraction methods; testing of optically anisotropic materials.		
Prerequisites and co-requisites	none		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lab assesement	55.0%	30.0%
	Written test	55.0%	70.0%
Recommended reading	Basic literature	Krystalografia, Z. Bojarski i in.	
	Supplementary literature	any textbook on crystallography or solid state physics	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<p>1. Consider the two-dimensional structure shown in Figure 1. (a) Select the nodes of the Bravais network. (b) Determine the primitive cell and the atomic basis according to your choice.2. The unit cell (cube) of a certain intermetallic compound is shown in the figure below. Name this structure and determine the summary formula of the compound.3. Draw the (314), (010) and (111) planes in a crystal with an orthorhombic structure with lattice constants $a = 4 \text{ \AA}$, $b = 6 \text{ \AA}$ and $c = 8 \text{ \AA}$. Write the indicators of the directions in which the closest atoms meet.4. Define the packing density and calculate it (find the expression, without numerical calculations) for the regular structure shown in the figure (the one for question 1), if it is known that the radius of Au is equal to 1.1 of the radius of Cu.5. State and explain the Bragg/Laue condition6. What defects in the crystal structure have the greatest impact on:a) mechanical properties of metals?b) color of ionic crystals?What is the impact? Justify your answers briefly.7. What is crystal anisotropy?</p>		
Work placement	Not applicable		

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