University of Gdańsk

Subject card

Subject name and code	Fundamentals of crystallochemistry, PG_00170311						
Field of study	Chemical Business, Chemistry						
Date of commencement of studies	October 2025		Academic year of realisation of subject	2026/2027			
Education level	Bachelor's studies		Subject group	Optional subject group			
Mode of study	full-time studies		Mode of delivery	at the university			
Year of study	2		Language of instruction	Polish polish			
Semester of study	4		ECTS credits	2.0			
Learning profile	academic		Assessment form	credit			
Conducting unit	Laboratory of Crystallochemistry -> Department of Physical Chemistry -> Faculty of Chemistry -> Rector						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. Artur Sikorski					
	Teachers						
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		5.0	15.0	50	
Subject objectives	Familiarizing students with the structure of crystals, the fundamental laws of crystallography and the equations that describe them, the classification of crystalline substances based on various criteria, and the method of determining the spatial structure of crystalline compounds using X-ray structural analysis.						

Learning outcomes	Course outcome	Subject outcome	Method of verification
	[BCHINŻ_U01] On the basis of the acquired knowledge, identifies, analyses and solves engineering tasks and problems in broadly understood chemistry.	Has structured and in-depth knowledge in the field of crystallochemistry necessary for identifying, analyzing, and solving engineering tasks and technical problems. The student defines a crystal, knows different types of unit cells, characterizes various crystallographic systems, distinguishes between a crystal lattice and a spatial lattice, characterizes individual elements of the spatial lattice (nodes, lines, planes), lists and describes elements of point and translational symmetry, explains the factors influencing the packing of atoms, ions, and molecules in a crystal lattice, explains various classification criteria, characterizes the structures of selected elements and chemical compounds, and explains how the spatial structure of chemical compounds is determined using the method of X-ray structural analysis of single crystals.	[SU1] oral statement/conversation/ discussion [SU5] implementation of a problem task
	[BCHINŻ_K05] Is convinced of the importance of behaving in a professional manner in every situation, taking full responsibility in the field of engineering activities and their impact on the natural environment and compliance with the principles of professional ethics.	Is aware of the importance of professional behavior in all situations, takes full responsibility for engineering activities and their impact on the natural environment, and adheres to the principles of professional ethics.	[SK1] oral statement/conversation/ discussion [SK5] implementation of a problem task
	[BCHINŻ_U09] Using the acquired knowledge, skills and various sources of scientific information independently prepares written papers and oral presentations.	Using acquired knowledge, skills, and various sources of scientific information, independently prepares written papers and oral presentations in the field of crystallochemistry.	[SU1] oral statement/conversation/ discussion [SU6] demonstration of practical skills [SU8] observation of student's independent or team work
	[BCHINŻ_U02] Uses basic methods, techniques and tools in formulating and solving engineering tasks in the field of chemistry.	Applies methods, techniques, and tools to formulate and solve engineering tasks in the field of crystallochemistry.	[SU1] oral statement/conversation/ discussion [SU5] implementation of a problem task [SU6] demonstration of practical skills
	[BCHINŻ_K03] Independently sets or implements a set action plan specifying priorities for its implementation; critically assesses its progress.	Independently establishes or executes an established action plan, defining priorities to ensure its implementation.	[SK8] observation of student's independent or team work
	[BCHINŻ_K02] Works individually demonstrating initiative and independence in actions, and effectively cooperates in a team, performing various roles in it.	Works independently demonstrating initiative and autonomy, and cooperates effectively in a team, performing various roles.	[SK5] implementation of a problem task
	[BCHINŻ_W07] Describes the construction and operating principles of basic scientific, technological and control-measuring apparatus.	Describes the construction and principles of operation of an X-ray diffractometer.	[SW1] oral statement/ conversation/discussion [SW5] implementation of a problem task
	[BCHINŻ_W02] Enumerates basic laws and theories in chemistry, physics and mathematics necessary to formulate and solve simple engineering tasks.	Identifies and recalls laws and theories in crystallochemistry, physics, and mathematics necessary for formulating and solving basic engineering tasks.	[SW1] oral statement/ conversation/discussion [SW3] text preparation/written work
	[BCHINŻ_U08] Uses the chemical nomenclature and engineering terminology properly.	Properly uses chemical nomenclature and engineering terminology.	[SU1] oral statement/conversation/ discussion [SU2] presentation/project/paper/ report
	[BCHINŻ_K01] Identifies the level of her/his own knowledge and skills as well as the need to update engineering knowledge, continuous professional training and personal development.	Identifies the level of own knowledge and skills, and recognizes the need for updating engineering knowledge, continuous professional development, and personal growth.	[SK1] oral statement/conversation/ discussion [SK8] observation of student's independent or team work

<table>
<tr><td>Subject contents</td><td colspan="3">The role of crystallography in modern chemistry. Definition of a crystal. Unit cell. Crystallographic systems. Crystal lattice. Spatial lattice. Classification of crystalline solids based on symmetry. Basic elements and symmetry operations. Symmetry in crystal morphology. Symmetry classes and their notation. Symmetry in the internal structure of crystals. Types of Bravais lattices. Translational symmetry. Space groups and their notation. Classification of crystalline solids based on chemical composition and stoichiometric ratios. Atomic packing in the crystal lattice: close packing, spatial arrangement of spheres, coordination number, voids. Structures of selected elements and chemical compounds. Fundamentals of X-ray structural analysis of single crystals. Sources and characteristics of X-ray radiation. Diffraction of X-ray radiation on the crystal lattice. Solving and refining crystal structures. Structural databases. Quasicrystals.</td></tr>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">General Chemistry Course</td></tr>
<tr><td>Assessment methods and criteria</td><td colspan="3"><table><tr><th>Subject passing criteria</th><th>Passing threshold</th><th>Percentage of the final grade</th></tr><tr><td>Written exam with open-ended questions (tasks)</td><td>50.01%</td><td>100.0%</td></tr></table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">A.1. Materials used during classes
1.Bojarski Z., Gigla M., Stróż K., Surowiec M., Crystallography, PWN, 2008.
2. Trzaska Durski Z., Trzaska Durska H., Fundamentals of Structural Crystallography and X-ray Diffraction, Publishing House of Warsaw University of Technology, 2003.

A.2. Materials for independent study by the student
1. Bojarski Z., Gigla M., Stróż K., Surowiec M., Crystallography, PWN, 2008.
2. Chojnacki J., Introduction to Crystallography, PWN, 2025.</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">1. Penkala, T., Outline of Crystallography, PWN, 1983.
2. Luger, P., Structural X-ray Diffraction of Single Crystals, PWN, 1989.
3. Wells, A. F., Structural Inorganic Chemistry, WNT, 1993.</td></tr>
<tr><td>eResources addresses</td><td colspan="2"></td></tr>
<tr><td>Example issues/ example questions/ tasks being completed</td><td colspan="3">Definitions of basic crystallochemical concepts: crystal, unit cell, crystallographic systems, crystal lattice, spatial lattice, classification of crystalline solids based on symmetry, types of Bravais lattices, classification of crystalline solids based on chemical composition and stoichiometric ratios, atomic packing in the crystal lattice (close packing), spatial arrangement of spheres, coordination number, voids, structures of selected elements and chemical compounds.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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