UNIWERSYTET GDAŃSKI

Course title
Krystalochemia/Crystal chemistry

ECTS code
13.3.0521

Name of unit administrating study
Faculty of chemistry

Studies

Field of study	Type	Form	
Chemistry	Master	Full-time studies	

Teaching staff
dr hab. Artur Sikorski, prof. UG

Forms of classes, the realization and number of hours

A. Forms of classes, in accordance with the UG Rector's regulations
Lecture, Exercises

B. The realization of activities
In-class learning

C. Number of hours
Lecture 15 h.; Exercises: 30 h.

ECTS credits
classes 45 h
Tutorial classes 10 h
Studnet's own work 45 h
TOTAL: 100 h - 4 ECTS

The academic cycle
First year, winter semester

Type of course
obligatory

Language of instruction
Polish

Teaching methods
Lecture (multimedia presentation)

Form and method of assessment and basic criteria for evaluation or examination requirements

A. Final evaluation, in accordance with the UG study regulations
exam for a grade

B. Assessment methods
determining the final grade based on partial grades received during the semester
written exam with open questions (tasks)

C. The basic criteria for evaluation or exam requirements
• lecture: students who have received positive grades from both tests can take the exam; the exam consists of 5 open questions, covering material discussed in the lecture and exercises detailed in the teaching content; final grade according to the scale of grades given in the Study Regulations; additional written exam for students who did not obtain the required 51% in the first term
• exercises: two tests, each covering a range of material from 7 exercises; test consists of 5 open questions, of which one is theoretical issues covering material discussed in the classes specified in the teaching content;. final grade according to the scale of grades given in the Study Regulations; additional written exam for students who did not obtain the required 51% in the first term

Required courses and introductory requirements
completed course in "General chemistry"

Aims of education
The familiarizing of students with the: structure of crystals; basic crystallographic laws and equations describing them; classification of crystalline materials based on various criteria; and with the method of determining the structure of monocrystalline materials using of single crystal X-ray diffraction method.

Course contents

A. Lecture

The role of crystallography in modern chemistry. Definition of the crystalline material. Crystal unit cell. Crystallographic systems. Crystal lattice and space lattice. Space groups. Classification of crystalline materials based on symmetry. Basic elements of symmetry and symmetry operations. Symmetry in crystal morphology. Symmetry classes and their symbolism. Symmetry in the structure of the crystals. Types of Bravais lattices. Translational symmetry. Space groups and their symbolism. Classification of crystalline materials based on chemical composition and stoichiometric ratios. Packing of atoms, ions and molecules in the crystal lattice - hexagonal arrangement of balls, coordination, interstices. Structures of selected elements and chemical compounds. Fundamentals of single-crystal X-ray diffraction method. Sources and characteristics of X-rays. X-ray diffraction on a crystal lattice. Solving and refining the crystal structure. Structural Databases. Quasicrystals.

B. Exercises

Characteristics of crystallographic systems. Crystal lattice and space lattice. Construction of the space lattice - coordinates of the location of lattice nodes, equations and indicators of lattice row and lattice planes. Basic crystallographic definitions: unit cell volume, interatomic and interplanar distances, interplanar angles, theoretical crystal density. Different forms of description of symmetry elements. Types of Bravais lattices. Geometry of coordination figures / polyhedrons. Packing of atoms in the crystal lattice - hexagonal arrangement of balls, degree of filling the crystal space, tetragonal and octahedral interstices. Types of chemical bonds. Atomic, ionic and van der Waals radiuses. Classification of crystalline materials based on chemical composition and stoichiometric ratios (according to Strukturbericht). Classification of structures according to Pearson's symbolism. Isomorphism and polymorphism. Structures of selected elements and chemical compounds.

Bibliography of literature

A. Literature required to pass the course :

1. Bojarski Z., Gigla M., Stróż K., Surowiec M., Krystalografia, PWN, 2008.
2. Trzaska Durski Z., Trzaska Durska H., Podstawy krystalografii strukturalnej i rentgenografii, Oficyna Wydawnicza. Politechniki Warszawskiej, 2003.

B. Extracurricular readings

1. Penkala, T., Zarys Krystalografii, PWN, 1983.
2. Luger, P., Rentgenografia strukturalna monokryształów, PWN, 1989.
3. Wells, A. F., Strukturalna chemia nieorganiczna, WNT, 1993.

Knowledge

Student: defines a crystal; draws different types of elementary cells; characterizes different crystallographic systems; distinguishes the crystal lattice from the space lattice; characterizes individual elements of the spatial lattice (nodes, rows, planes); describes the elements of point and translational symmetry; explains what packing depends on of atoms, ions and molecules in the crystal lattice; explains the different criteria of division of crystals; characterizes the structures of selected elements and chemical compounds; explains how to determine the structure of chemical compounds using single-crystal X-ray diffraction method

Social competence

Student:
• strives to acquire knowledge,
• works independently, and in a team performing different roles in it,
• shows creativity during the presentation of results,
• engages in solving scientific problems,
• cares for the acquisition of knowledge by others,
• discusses scientific problems (theses)

Skills

Student:
• organizes workshop.
• solves scientific problems, critically refers to the results obtained,
• proposes alternative methods of solving scientific problems,
• analyzes the results obtained based on their knowledge,
• draws conclusions based on experimental data,
• verifies the results based on literature data

Kontakt

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