GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	Diffraction Methods in Bionanomaterials Research, PG_00069341		
Field of study	Nanotechnology		
Date of commencement of studies	October 2024	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	2	Language of instruction	Polish
Semester of study	4	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Division of Strongly Correlated Electronic Systems -> 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. Tomasz Klimczuk	
	Teachers	prof. dr hab. inż. Tomasz Klimczuk	

Lesson types and methods of instruction

Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
Number of study hours	0.0	0.0	15.0	0.0	0.0	15

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	15	3.0	32.0	50

Subject objectives

The course aims to familiarize students with diffraction methods used in structural research, as well as with tools for analyzing diffraction patterns and visualizing crystal structures.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K6_U04] can plan and conduct experiments, critically analyze their results, draw conclusions and formulate opinions. Has laboratory experience.	The student is ready for laboratory work. He plans and conducts experiments, carefully analyzes the results, draws conclusions, and forms brilliant opinions.	[SU2] Assessment of ability to analyse information
[K6_U02] can analyze and solve simple scientific and technical problems based on possessed knowledge, applying analytical, numerical, simulation and experimental methods.	Students solve scientific problems based on their knowledge. In doing so, they apply the methods they have learned in other subjects.	[SU3] Assessment of ability to use knowledge gained from the subject
[K6_W07] has systematic knowledge of the physical and chemical principles of nanotechnology (methods of obtaining nanostructures, types of nanostructures, their properties, basic research methods).	The student has knowledge of how various nanostructures are obtained, what their physical properties are, and how these properties can be studied.	[SW2] Assessment of knowledge contained in presentation

Subject contents

1. Introduction to the course.
2. Diffraction methods (single crystal testing technique, polycrystal testing technique, etc.).
3. Introduction to ICSD/FindIt and CoD databases.
4. Imaging of crystallographic structures using VESTA software.
5. Introduction to the Rietveld and LeBail methods.
6. Mathematical foundations of the Rietveld method.
7. FullProf Suite software package.

<table>
<tr><td>Prerequisites and co-requisites</td><td colspan="3">Basic knowledge of crystallography. Computer skills are welcome.</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>final exam</td><td>60.0%</td><td>60.0%</td></tr>
<tr><td>practical task</td><td>60.0%</td><td>40.0%</td></tr>
</table></td></tr>
<tr><td rowspan="3">Recommended reading</td><td>Basic literature</td><td colspan="2">1. Podręcznik FullProf https://www.psi.ch/sinq/dmc/ManualsEN/fullprof.pdf

2. L.B. McCusker, et al. Rietveld refinement guidelines, J. Appl. Cryst. (1999) vol. 32, 36-50

3. B. H. Toby, R-factors: how good is good enough?, Powder Diffraction (2006) vol. 21, 67-70

4. D. S. Sivia, Elementary Scattering Theory For X-ray and Neutron Users, Oxford University Press (2014)

5. H. M. Rietveld, A profile refinement method for nuclear and magnetic structures, Journal of Applied Crystallography (1969) vol. 2, 65-71 http://epswww.unm.edu/media/pdf/Rietveld-1969-ProfileRefinement.pdf</td></tr>
<tr><td>Supplementary literature</td><td colspan="2">none</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">Using the Vesta program, draw and then discuss the details of the structure of the Mg10Ir19B16 compound.</td></tr>
<tr><td>Work placement</td><td colspan="3">Not applicable</td></tr>
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