



## Subject card

Subject name and code	Nanoscopy, PG_00048987						
Field of study	Corrosion						
Date of commencement of studies	February 2024	Academic year of realisation of subject			2024/2025		
Education level	second-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	1	Language of instruction			Polish		
Semester of study	2	ECTS credits			4.0		
Learning profile	general academic profile	Assessment form			exam		
Conducting unit	Department of Electrochemistry, Corrosion and Materials Engineering -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor	dr hab. inż. Artur Zieliński					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	30.0	0.0	0.0	45
	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	45	5.0		50.0	100	
Subject objectives	To familiarize students with various techniques of imaging and analysis of the surface of modern construction materials.						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	K7_U05	The student can explain the presence of various topographic forms visible on the microscopic image.			[SU3] Assessment of ability to use knowledge gained from the subject		
	K7_U03	The student is able to interpret the image obtained by means of various microscopic techniques.			[SU2] Assessment of ability to analyse information		
	K7_W04	Student is able to choose a set of measurement methods to perform a specific task.			[SW1] Assessment of factual knowledge		
	K7_K01	Student is able to define the need for a specific microscopic examination and knows what tool should be used for this purpose.			[SK3] Assessment of ability to organize work		
Subject contents	Electron microscopy, atomic force microscopy in various modes, tunneling microscopy, electrochemical microscopy.						
Prerequisites and co-requisites	General knowledge of surface physicochemistry.						
Assessment methods and criteria	Subject passing criteria	Passing threshold			Percentage of the final grade		
	Kolokwium	60.0%			50.0%		
	Obecność, sprawozdania	100.0%			50.0%		

Recommended reading	Basic literature	<p>Dror Sarid, Scanning Force Microscopy. With Applications to Electric, Magnetic, and Atomic Forces ISBN13: 978-0-19-509204-2</p> <p>Robert Kelsall, Ian Hamley, Mark Geoghegan, Nanotechnology, ISBN: 9788301155377</p> <p>Sergei V. Kalinin, Alexei Gruverman, Scanning Probe Microscopy. Electrical and Electromechanical Phenomena at the Nanoscale, ISBN: 978-0-387-28667-9</p> <p>Rebecca Howland, Lisa Benatar, STM / AFM. Mikroskopy ze skanującą sondą. Elementy teorii i praktyki. Warszawa 2002.</p>
	Supplementary literature	publications from the JCR list
	eResources addresses	Adresy na platformie eNauczenie:
Example issues/ example questions/ tasks being completed	<ol style="list-style-type: none"> <li>1. Describe one advantage of tunneling electron microscopy.</li> <li>2. Describe one disadvantage of tunneling microscopy in relation to the electron microscopy.</li> <li>3. Why tunnel microscopy owes its extremely high resolution?</li> <li>4. How does the tunnel current depend on the probe's distance from the sample?</li> </ol>	
Work placement	Not applicable	