



## Subject card

Subject name and code	Microscopic test methods, PG_00039689						
Field of study	Materials Engineering, Materials Engineering, Materials Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject		2022/2023		
Education level	second-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	1		Language of instruction		Polish		
Semester of study	1		ECTS credits		2.0		
Learning profile	general academic profile		Assessment form		assessment		
Conducting unit	Department of Electrochemistry, Corrosion and Materials Engineering -> Faculty of Chemistry						
Name and surname of lecturer (lecturers)	Subject supervisor		dr inż. Łukasz Gawel				
	Teachers		dr inż. Łukasz Gawel				
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		15.0	50
Subject objectives	The goal is to make students familiar with different microscopic techniques: - they should be able to distinguish pros and cons of each technique and capable to select technique for specific task - they should be able to use obtained knowledge for proper imaging of samples - students should know basic parameters related with image quality						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	K7_K01		Student is capable to correctly choose the measurement tool for a specific need, and ask for help in the analysis and interpretation of test results. He is aware of the development of measurement techniques.		[SK5] Assessment of ability to solve problems that arise in practice		
	K7_W06		Student understands the basic terms and concepts associated with microscopic techniques. Understands the general laws on which the discussed techniques are based. Student is able to choose a technique for a particular need, knows its possibilities and limitations. Knows the development trend of microscopic techniques.		[SW1] Assessment of factual knowledge		
	K7_U06		Student is able to assess the possibility of using new measurement techniques as well as modification of existing techniques in order to increase the obtained analytical information.		[SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information		
Subject contents	Lectures: evolution of microscopy techniques, optical microscopy, metallographic, confocal and fluorescent, Raman microscopy, scanning techniques - SEM, STM, AFM and similar, spectroscopic mapping, XPS AES and ellipsometry, electrochemical mapping DEIS						
Prerequisites and co-requisites	Good understanding of basic physics, in particular optics. Communication in english is advised.						

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
		60.0%	40.0%
		60.0%	50.0%
		60.0%	10.0%
Recommended reading	Basic literature	R. Feynmann, Feynmana wykłady z fizyki. T. 1, cz. 2, PWN, Warszawa, 2012 R. Kelsall, I. Hamley, M. Geoghegan, Nanotechnologie, PWN, Warszawa, 2008 J. Watts, J. Wolstenholme, Surface analysis by XPS and AES, Wiley, New York, 2003	
	Supplementary literature	articles from JCR list,  materlas from <a href="http://www.e-korozja.pl">http://www.e-korozja.pl</a>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	Use of various microscopes,  elimination of image defects,  Improvement of resolution and contrast  Sample preparation  Selection of technique for given samples		
Work placement	Not applicable		