



Subject card

Subject name and code	ADVANCED METHODS IN RESEARCH OF MATERIALS, PG_00052987						
Field of study	Chemistry in Construction Engineering						
Date of commencement of studies	February 2023		Academic year of realisation of subject			2022/2023	
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	1		ECTS credits			5.0	
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 inż. Łukasz Gawel				
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	30.0	0.0	0.0	60
	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	60		6.0		59.0	125
Subject objectives	The goal of this lecture is to familiarize students with advanced techniques to analyze physicochemical properties of different materials. The students are to use acquired knowledge to properly determine the capabilities and limitations of measurement techniques in individual cases.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	K7_U07		Student is able to choose a microscopic technique to serve particular goal, know their possibilities and limitations. Student has the ability to interpret measurement data. Can handle SEM and AFM microscopes, Raman spectroscopy, XPS, perform impedance and ellipsometric measurements. Student is able to prepare samples for measurements and specify requirements of pretreatment for each technique.			[SU4] Assessment of ability to use methods and tools [SU3] Assessment of ability to use knowledge gained from the subject [SU1] Assessment of task fulfilment	
	K7_U03		Student is able to prepare analyses of results, focusing on information relevant to the solution of given problem			[SU5] Assessment of ability to present the results of task [SU2] Assessment of ability to analyse information	
	K7_W06		Student has broadened knowledge of the measurement techniques under discussion. Knows the theoretical foundations of their operation and construction.			[SW1] Assessment of factual knowledge	
Subject contents	<p>Lectures are divided into three blocks - microscopic, spectroscopic and electrochemical techniques. In the first part of semester topics are SEM, TEM along with related analytical techniques (EDX, EBSD), AFM and other techniques that use scanning probe, STM. The second block of classes will focus on discussing surface analysis techniques - XPS and AES, Raman spectroscopy, ellipsometric techniques, SIMS, the third block focus on chronovoltrammety, impedance spectroscopy and harmonic analysis.</p> <p>As part of the laboratory, students will work with above mentioned techniques, in particular, SEM / EDX, AFM / SPM, STM, CRM, XPS, DEIS / LEIS, ellipsometry and use them to examine construction materials and to evaluate various forms of degradation.</p>						

Prerequisites and co-requisites	<p>Basic knowledge of classical physics, in particular optics and foundations of quantum mechanics. Knowledge in area of materials science, in particular the types and properties of construction materials, their structure and forms of degradation.</p> <p>English (also technical) on at least intermediate level</p>		
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Report	60.0%	10.0%
	Exam	60.0%	50.0%
	Laboratory tests	60.0%	40.0%
Recommended reading	Basic literature	-	
	Supplementary literature	<p>Scientific articles from ISI lists, didactic materials available at www.e-korozja.pl</p>	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	<p>Handling of each microscope or spectroscope Requirements for sample preparation Forms of sample Selection of appropriate measurement techniques</p>		
Work placement	Not applicable		