



## Subject card

Subject name and code	Methods of materials testing, PG_00058356						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	October 2024	Academic year of realisation of subject			2026/2027		
Education level	first-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	3	Language of instruction			Polish		
Semester of study	5	ECTS credits			3.0		
Learning profile	general academic profile	Assessment form			assessment		
Conducting unit	Katedra Inżynierii Materiałów Funkcjonalnych WET1 -> Faculty of Electronics, Telecommunications and Informatics						
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. inż. Piotr Jasiński					
	Teachers						
Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	30.0	0.0	15.0	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	6.0		24.0		75
Subject objectives	The aim of the course is to familiarise students with materials characterisation methods for hydrogen and electromobility technologies						
Learning outcomes	Course outcome	Subject outcome			Method of verification		
	[K6_W17] knows the methods of researching engineering materials, has knowledge in the field of materials science and is able to relate the properties of materials with their structure and composition	The student is familiar with testing methods for engineering materials and has a basic knowledge of materials science, which enables him/her to relate the properties of materials to their structure and composition.			[SW1] Assessment of factual knowledge		
	[K6_U01] Is able to obtain information from literature, databases and other sources, integrate them, interpret them and draw conclusions and formulate opinions; has the ability to self-educate m.in. in order to improve professional competences	Students are able to effectively obtain and integrate information from various sources, such as literature, databases and other available materials. He/she is able to interpret the collected data, draw conclusions on their basis and formulate his/her own opinions. Moreover, he/she has the ability of self-education in order to continuously improve his/her professional competences.			[SU4] Assessment of ability to use methods and tools		
Subject contents	Spectroscopic methods of materials testing comparison of UV-VIS and IR spectroscopy. Spectroscopic methods of materials testing comparison of methods: classical IR spectroscopy, FTIR spectroscopy and Raman spectroscopy. Optical microscopy and electron microscopy. EDX spectroscopy. Impedance spectroscopy - what can be measured, 2, 3 and 4 electrode measurements. Impedance spectroscopy surrogate schemes (Randles and Brick Layer Model), fitting results to surrogate schemes, spectrum analysis methods (DRT). Application of impedance spectroscopy to the analysis of two-phase systems. Gas chromatography measurement system and detectors used. X-ray diffraction. Measurements of single-phase, two-phase systems and thin films. Microscopy of atomic forces.						
Prerequisites and co-requisites							

Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	Lecture	50.0%	70.0%
	Lab	50.0%	30.0%
Recommended reading	Basic literature	W. Szczepaniak, Metody instrumentalne w analizie chemicznej, PWN 2007 R.M. Silverstein, Francis X. Webster, David J. Kiemle, Spektroskopowe metody identyfikacji związków organicznych, Wydawnictwo Naukowe PWN 2007 A. Cygański, Metody Spektroskopowe w Chemii Analitycznej, WNT 2002	
	Supplementary literature	Bogusz W., Krok F., Elektrolicy stałe, WNT 1995	
	eResources addresses	Adresy na platformie eNauczanie:	
Example issues/ example questions/ tasks being completed	What is the difference between FTIR and Raman spectroscopy?		
Work placement	Not applicable		

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