



Subject card

Subject name and code	Fuel cells and low temperature electrolysers, PG_00058352						
Field of study	Hydrogen Technologies and Electromobility						
Date of commencement of studies	October 2022	Academic year of realisation of subject			2023/2024		
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	2	Language of instruction			Polish		
Semester of study	4	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	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	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	8.0		72.0		125
Subject objectives	The aim of the course is to familiarize students with low-temperature electrolysers and fuel cells. During the course, students will become familiar with the construction of cells and electrolysers. They learn the principles of operation and the impact of operating parameters on the efficiency of fuel cells, i.e. temperature, flow rate, humidification. They will become familiar with basic measurement techniques for evaluating fuel cells performance.						
Learning outcomes	Course outcome		Subject outcome			Method of verification	
	[K6_U02] can work individually and in a team, can communicate using various techniques in a professional environment, as well as document and analyze the results of their work, can estimate the time needed to perform the entrusted task		Student is able to use measurement techniques and solve problems related to fuel cells and electrolysers.			[SU5] Assessment of ability to present the results of task [SU4] Assessment of ability to use methods and tools [SU2] Assessment of ability to analyse information	
	[K6_W21] has knowledge in the field of construction, principles of operation and use of electrochemical energy sources		Student is able to identify individual elements of a low-temperature fuel cell. Is able to describe the principle of operation and areas of application of low-temperature fuel cells.			[SW1] Assessment of factual knowledge	
	[K6_W20] has knowledge in the field of construction, principles of operation and use of electrolysers		Student is able to identify individual elements of the electrolyzer. Is able to describe the principle of operation and areas of application of low-temperature electrolysers.			[SW1] Assessment of factual knowledge	

Subject contents	<p>Basics of construction of low-temperature electrolysers and fuel cells. Electrode reactions, cell emf Types of losses in low-temperature cells and electrolysers The influence of temperature and pressure on the operation of cells. Basic measurement techniques for assessing the properties of electrolysers and low-temperature cells. Application of low-temperature cells and electrolysers.</p>											
Prerequisites and co-requisites	<p>Knowledge of the basics of electrochemistry and technical electrochemistry. Knowledge of the basics of electrical engineering.</p>											
Assessment methods and criteria	<table border="1"> <thead> <tr> <th data-bbox="456 651 786 680">Subject passing criteria</th> <th data-bbox="790 651 1139 680">Passing threshold</th> <th data-bbox="1142 651 1481 680">Percentage of the final grade</th> </tr> </thead> <tbody> <tr> <td data-bbox="456 685 786 714">Lectures</td> <td data-bbox="790 685 1139 714">60.0%</td> <td data-bbox="1142 685 1481 714">40.0%</td> </tr> <tr> <td data-bbox="456 719 786 748">Laboratory</td> <td data-bbox="790 719 1139 748">60.0%</td> <td data-bbox="1142 719 1481 748">60.0%</td> </tr> </tbody> </table>	Subject passing criteria	Passing threshold	Percentage of the final grade	Lectures	60.0%	40.0%	Laboratory	60.0%	60.0%		
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Lectures	60.0%	40.0%										
Laboratory	60.0%	60.0%										
Recommended reading	Basic literature	<p>1. J. Larminie, A. Dicks „Fuel cell systems explained, Willey, 2003. 2. K. Kordesh, G. Simader „Fuel cells and their applications, VCH, 2001</p>										
	Supplementary literature	<p>1. P. W. Atkins: „Chemia fizyczna", PWN, Warszawa 2001.</p>										
	eResources addresses	<p>Adresy na platformie eNauczanie: OGNIWA PALIWOWE I ELEKTROLIZERY NISKOTEMPERATUROWE - Moodle ID: 36954 https://enauczanie.pg.edu.pl/moodle/course/view.php?id=36954</p>										
Example issues/ example questions/ tasks being completed	<p>The influence of temperature on cell efficiency The influence of reactant flow rates on efficiency. Describe the current-voltage curve of the cell. Write down the reactions taking place in the electrolyzer/cell</p>											
Work placement	<p>Not applicable</p>											