



Subject card

Subject name and code	ELECTROCHEMICAL ENERGY SOURCES, PG_00064331						
Field of study	Chemical Technology						
Date of commencement of studies	February 2027		Academic year of realisation of subject		2026/2027		
Education level	second-cycle studies		Subject group		Optional subject group Specialty 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		3.0		
Learning profile	general academic profile		Assessment form		exam		
Conducting unit	Department of Corrosion and Electrochemistry -> Faculty of Chemistry -> Faculties of Gdańsk University of Technology						
Name and surname of lecturer (lecturers)	Subject supervisor		dr hab. inż. Andrzej Nowak				
	Teachers						
Lesson types	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		25.0	75
Subject objectives	Familiarization with the principles of operation and practical implementation of various electrochemical energy sources.						
Learning outcomes	Course outcome		Subject outcome		Method of verification		
	[K7_W01] defines the phenomena, processes and laws of nature used to produce consumer goods and provide services		knows and understands the principles of designing medium-scale systems for selected electrochemical processes.		[SW1] Assessment of factual knowledge		
	[K7_U02] carries out experiments using properly selected techniques and apparatus, taking advantage of new developments in technology and related fields		is able to translate theoretical knowledge about the thermodynamics and kinetics of electrode processes into understanding the operation of various energy sources.		[SU1] Assessment of task fulfilment		
	[K7_K01] critically evaluates the content of cognitive and practical problems		is ready to undertake activities related to the diagnosis and optimization of energy sources in a responsible manner, taking into account social, environmental, and economic aspects.		[SK4] Assessment of communication skills, including language correctness		

Subject contents	Course content – lecture Lectures 1-2: Electrochemical Energy Sources Device Map and Metrics Lectures 3-4: Three-Electrode Systems and Measurement Accuracy in the Context of Electrochemical Energy Lectures 5-6: Charge Storage Mechanisms EDLC, Pseudocapacitance, Battery Redox Lectures 7-8: CV and Time-of-Flight Techniques for Material Evaluation for Energy Sources Lectures 9-10: Separation of Surface and Diffusion Contributions Trasatti and Dunn in Material Evaluation Lectures 11-12: EIS as an Energy Source Diagnostic Resistance, Kinetics, Diffusion Lectures 13-15: Materials and Reactions for Energy Conversion HER and an Overview of Batteries and Cells		
	Course content – laboratory 1. Cyclic voltammetry characterization of electrode processes 2. Study of aniline electropolymerization processes 3. EDLC/redox mechanisms 4. Trasatti method contribution of mechanisms to charge accumulation 5. Study of the diffusion coefficient using electrochemical impedance spectroscopy 6. Measurement of charge transfer resistance. 7. Electrode materials for hydrogen evolution		
Prerequisites and co-requisites			
Assessment methods and criteria	Subject passing criteria	Passing threshold	Percentage of the final grade
	lecture (exam)	60.0%	40.0%
	laboratory (reports)	60.0%	60.0%
Recommended reading	Basic literature	Electrochemical Power Sources: Batteries, Fuel Cells, and Supercapacitors By Vladimir S. Bagotsky, Alexander M. Skundin and Yury M. Volfkovich (A.N. Frumkin Institute of Physical Chemistry and Electrochemistry of the Russian Academy of Science, Russia), John Wiley & Sons Inc, New Jersey, USA, 2015, 372 pages, ISBN: 978-1-118-46023-6	
	Supplementary literature	1. Sobczyk Lucjan, Kiswa Adolf, Gatner Kazimierz, Koll Aleksander - Eksperymentalna chemia fizyczna, PWN 1982 2. W.R. Browne - Elektrochemia, PWN, 2022	
	eResources addresses		
Example issues/ example questions/ tasks being completed	1. Please discuss the classes of electrochemical energy sources. 2. What are the charge storage mechanisms? 3. Methods for measuring the diffusion coefficient.		
Practical activities within the subject	Not applicable		

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