GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

Subject name and code	MATERIALS FOR ENERGY STORAGE AND CONVERSION DEVICES, PG_00048967		
Field of study	Green Technologies		
Date of commencement of studies	February 2024	Academic year of realisation of subject	2024/2025
Education level	second-cycle studies	Subject group	Obligatory subject group in the field of study
Mode of study	Full-time studies	Mode of delivery	at the university
Year of study	1	Language of instruction	English
Semester of study	2	ECTS credits	2.0
Learning profile	general academic profile	Assessment form	assessment
Conducting unit	Department of Chemistry and Technology of Functional Materials -> Faculty of Chemistry		
Name and surname of lecturer (lecturers)	Subject supervisor	prof. dr hab. Anna Lisowska-Oleksiak	
	Teachers		

Lesson types and methods of instruction	Lesson type	Lecture	Tutorial	Laboratory	Project	Seminar	SUM
	Number of study hours	15.0	0.0	0.0	15.0	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 aim of the subject is to provide students with the knowledge and skills related to materials engeening and chemistry of electrode and electrolytes used in electric energy storage and conversion devices (EESCD). Konwlege and skill are necessary for conscious participation in the development of technology for the EECSD by taking into account the use of new generation conductive materials.

Learning outcomes

Course outcome	Subject outcome	Method of verification
[K7_W03] will have a detailed knowledge of the theoretical basis of methods and types of apparatus used in chemical analysis of environmental pollutants and the technology of cleaning and neutralization of industrial waste and wastewater management and the design and supervision of environmentally friendly technologies	The student has detailed knowledge in the field of basic of chemistry and electrochemistry, electrodes and electrolytes and theirs potential use in storage devices and electricity conversion. Has knowledge of technology the production and recovery of these materials.	
[K7_W01] a broader and deeper knowledge of certain branches of mathematics, including elements of applied mathematics and optimization methods including mathematical methods, useful to formulate and solve complex tasks in the field of environmental technologies and modern analytical methods	Student ma wiedzę i umiejętności w zakresie sposobu wykorzystania materiałów w urządzeniach takich jak ogniwa pierwotne, akumulatory (ogniwa wtórne), ogniwa przepływowe, ogniwa paliwowe m.in PMFC MCFC, PAFC,	
[K7_K05] is ready to explain the basic concepts of the protection of industry property and copyright and the need for management of intelectual property, it turns the attention to the prestige associated with the profession and profession solidarity properly understaning, shows respect for others and concern for their welfare, understands the need to promote, formulate and provide the public with information and opinions concerning the activities of the profession of Engineer, is aware of the social role of a technical college graduate	The student knows the rules of protection intellectual property and law copyright and knows how secure your own interests concept in terms of material design and storage devices and electricity conversion	

Subject contents

Metals as electrodes and electron collectors in aqueous and non aqueous systems, metallic nanoparticles. Carbons 3D, 2D, 1 D, Carbons nanstructures. Organic semiconductors “Synthetic metals” – p-type, n-type. Inorganic semiconductors: oxides, selenides, sulfides, iodides, other. Intercalation electrodes. Mixed conductors (MIEC). Photoactive semiconducting materials.

Aqueous electrolytes in commercial products. Dissolved redox couples for energy conversion in redox flow cells (RFC).

Non-aqueous electrolytes. Polymeric and gel type electrolytes. Membranes – polymeric, inorganic. Solid crystalline electrolytes: proton conductors, oxygen conductors, univalent cation conductors, multivalent cation solid electrolytes. Organic solid proton conductors.

All above mentioned materials are chosen as a potential electrode/electrolyte for: Primary cell (PrC), Secondary cells (SdC), Redox flow cells RFC, Fuel Cell (FC), , Electrolytic cells for e.g. gas reforming, Electrochemical Capacitors (ECaps of various kinds), Combining two type electrodes - capacitor and SdC in one device, Photocapacitors, Photoelectrochemical cells.

Prerequisites and co-requisites

Assessment methods and criteria

Subject passing criteria	Passing threshold	Percentage of the final grade
Test	51.0%	60.0%
reports and presentation	100.0%	40.0%

Recommended reading

Basic literature	Materiały do wykładu - plik pdf, przygotowany na podstawie: 1.V.S. Bagotsky, A.M. Skundin and Y. M. Volfkovich, Electrochemical Power Sources: Batteries, Fuel Cells and Supercapacitors, Wiley, 2015. 2. Nonaqueous electrochemistry ed. Doron Aurbach Marcel Decker , INc 1999 3.G. Inzlet Conducting Polymers ed. F. Scholtz , Springer-Verlag 2008 4. Fiona Gray Solid Polymer Electrolytes, Fundamentals and Technological Application VCH 1998 5. B.E. Conway, Electrochemical Capacitors, Scientific fundamentals and technological applications, KA/PP New York 1999
Supplementary literature	current articles

	eResources addresses	Adresy na platformie eNauczanie:
Example issues/ example questions/ tasks being completed		
Work placement	Not applicable	