



Subject card

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|---|---|--|----------|-------------------------------------|--|------------|-----|
| Subject name and code | MATERIALS FOR ENERGY STORAGE AND CONVERSION DEVICES, PG_00048967 | | | | | | |
| Field of study | Green Technologies | | | | | | |
| Date of commencement of studies | October 2023 | Academic year of realisation of subject | | | 2023/2024 | | |
| 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 | 1 | 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 engineering and chemistry of electrode and electrolytes used in electric energy storage and conversion devices (EESCD). Knowledge and skill are necessary for conscious participation in the development of technology for the EESCD by taking into account the use of new generation conductive materials. | | | | | | |

| Learning outcomes | Course outcome | Subject outcome | Method of verification |
|---------------------------------|--|---|--|
| | [K7_K05] is ready to explain the basic concepts of the protection of industry property and copyright and the need for management of intellectual property, it turns the attention to the prestige associated with the profession and profession solidarity properly understanding, 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 | [SK3] Assessment of ability to organize work [SK5] Assessment of ability to solve problems that arise in practice [SK1] Assessment of group work skills |
| | [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 their potential use in storage devices and electricity conversion. Has knowledge of technology the production and recovery of these materials. | [SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects |
| | [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 przeplywowe, ogniwa paliwowe m.in PMFC MCFC, PAFC, | [SW1] Assessment of factual knowledge [SW2] Assessment of knowledge contained in presentation [SW3] Assessment of knowledge contained in written work and projects |
| Subject contents | <p>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.</p> <p>Aqueous electrolytes in commercial products. Dissolved redox couples for energy conversion in redox flow cells (RFC).</p> <p>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.</p> <p>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.</p> | | |
| 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 | <p>Materiały do wykładu - plik pdf, przygotowany na podstawie:</p> <ol style="list-style-type: none"> 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 | |

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