GDAŃSK UNIVERSITY OF TECHNOLOGY

Subject card

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|---|---|---|---|
| Subject name and code | Fuel cells and high temperature electrolysers, PG_00058357 | | |
| 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<br>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 WETI -> 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 | 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 | 6.0 | 24.0 | 75 |

**Subject objectives**

The aim of the course is to learn about the mechanisms of operation, design and materials used in the construction of high-temperature fuel cells and electrolysers

**Learning outcomes**

| Course outcome | Subject outcome | Method of verification |
|---|---|---|
| [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 | The student is able to obtain information effectively from a variety of sources such as literature, databases and other available materials on topics related to high-temperature fuel cells and electrolysers | [SU1] Assessment of task fulfilment |
| [K6_W18] knows the construction and operation of high-temperature fuel cells and electrolysers powered by hydrogen and other fuels and their practical application for energy generation and storage | The student knows the principles of construction and operation of high temperature fuel cells (SOFC) and electrolysers (SOEC), including the mechanisms of energy conversion and the chemical reactions occurring in these devices | [SW1] Assessment of factual knowledge |

**Subject contents**

Fundamentals of fuel cells and electrolysers. The role of fuel cells and electrolysers in energy systems. Applications of high temperature fuel cells (SOFC) and electrolysers (SOEC). Mechanism of conversion of chemical energy of fuel into electrical energy. Structure and materials used in SOFCs: electrodes, electrolytes, interconnectors. Chemical reactions occurring in SOFCs: hydrogen oxidation, oxygen reduction. Principle of operation and differences between SOFC and SOEC. High temperature water electrolysis process: hydrogen production. Materials used in SOEC and their characteristics. Production methods for fuel cells and electrolysers. Technological problems and challenges of high temperature fuel cells and electrolysers. Energy efficiency and performance. Durability and stability of operation at high temperatures. Technical issues such as material degradation and corrosion. Industrial and domestic applications of SOFCs: micro-cogeneration, backup power. Examples of practical SOFC and SOEC implementations.

**Prerequisites and co-requisites**

**Assessment methods and criteria**

| Subject passing criteria | Passing threshold | Percentage of the final grade |
|---|---|---|
| Lecture - test | 50.0% | 60.0% |
| Lab | 50.0% | 40.0% |

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|---|---|---|
| Recommended reading | Basic literature | SINGHAL, Subhash C.; KENDALL, Kevin (ed.). *High-temperature solid oxide fuel cells: fundamentals, design and applications*. Elsevier, 2003.<br><br>HUANG, Kevin; GOODENOUGH, John B. Solid oxide fuel cell technology: principles, performance and operations. 2009.<br><br>GODULA-JOPEK, Agata. *Hydrogen production: by electrolysis*. John Wiley & Sons, 2015 |
| | Supplementary literature | LARMINIE, James; DICKS, Andrew; MCDONALD, Maurice S. *Fuel cell systems explained*. Chichester, UK: J. Wiley, 2003. |
| | eResources addresses | Adresy na platformie eNauczanie: |
| Example issues/ example questions/ tasks being completed | Describe the designs and generations of fuel cells | |
| Work placement | Not applicable | |

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