COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrochemistry [S1Elmob1>ECH1]

Course

Field of study
Electromobility

Year/Semester
1/2

Area of study (specialization)
–

Profile of study
general academic

Level of study
first-cycle

Course offered in
Polish

Form of study
full-time

Requirements
compulsory

Number of hours

Lecture
30

Laboratory classes
0

Other (e.g. online)
0

Tutorials
0

Projects/seminars
0

Number of credit points

2,00

Coordinators

prof. dr hab. inż. Grzegorz Lota
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Lecturers

Prerequisites

The student has a basic knowledge of chemistry, physics and mathematics acquired at high school. The student is aware of the limitations of his own knowledge and understands the need for further improvement (training).

Course objective

The aim of the course is to provide students with knowledge of electrochemistry, electrochemical processes, with particular emphasis on chemical power sources.

Course-related learning outcomes

Knowledge:
Student has an ordered and theoretically founded basic knowledge in the field of chemistry and electrochemistry, including the area of electrochemical and chemical power sources

Skills:
Student is able to use literature sources, integrate obtained information, evaluate it and interpret it and draw conclusions in order to solve complex and unusual problems in the field of electromobility

Student is able to plan and carry out experiments, including measurements of basic measurable quantities characteristic for electromobility in typical and not fully predictable conditions; is able to present the obtained results in numerical and graphic form, interpret them and draw appropriate conclusions

Social competences:
Student understands the importance of knowledge in solving problems in the field of electromobility; is aware of the necessity to use the knowledge of experts when solving engineering tasks beyond their own competences

Methods for verifying learning outcomes and assessment criteria

Learning outcomes presented above are verified as follows:

Learning outcomes presented above are verified as follows:
1. Written final test.

Programme content

1. Fundamentals of electrochemistry.
2. Mechanism and kinetics of electrode processes.
3. Corrosion.
4. Electroplating.
5. Electrochemical energy storage; the principle of operation, structure, construction, operating characteristics.
6. Lithium-ion batteries.
7. Nickel - hydride batteries.
8. Lead-acid batteries
9. Supercapacitors.

Course topics

1. Fundamentals of electrochemistry.
a) basic concepts of chemistry and electrochemistry
b) valency of elements
c) calculation of a solution concentrations
2. Mechanism and kinetics of electrode processes.
a) oxidation and reduction in electrochemical processes
b) electrolyser and galvanic cell
c) Faraday's law
d) calculus tasks from Faraday's 1st law
3. Corrosion.
a) kinetics and thermodynamics of the corrosion process
b) types of corrosion
c) methods of protection against corrosion
4. Electroplating.
a) zinc coatings
b) nickel coatings
c) copper coatings
5. Electrochemical energy storage; the principle of operation, structure, construction, operating characteristics.
a) calculation tasks relating to the charge and energy of chemical power sources
6. Lithium-ion batteries.
a) principle of operation
b) construction and types of Li-ion batteries
(c) electrode materials and electrolytes
7. Nickel - hydride batteries.
a) principle of operation
b) construction and types of Ni-MH batteries
(c) electrode materials
8. Lead-acid batteries

a) principle of operation
b) construction and types of Pb/PbO2 batteries
(c) electrode materials
9. Supercapacitors.
a) working principle
b) construction and types of electrochemical capacitors
-double layer capacitors
-asymmetric
-hybrid
c) electrode materials and electrolytes

Teaching methods

Lecture

Bibliography

Basic
1. A.Ciszewski, Technologia chemiczna, procesy elektrochemiczne, Wydawnictwo Politechniki Poznańskiej, Poznań 2008.
2. A. Czerwiński, Akumulatory, bateria, ogniwa, WKŁ, Warszawa 2005.
Additional
3. H. Sholl, T. Błaszczyk, P. Krzyczmonik, Elektrochemia. Zarys teorii i praktyki, Wydawnictwo Uniwersytetu Łódzkiego, Łódź 1998.
4. A. Kisza, Elektrochemia. Tom I: Jonika, WNT, Warszawa 2000.
5. A. Kisza, Elektrochemia. Tom II: Elektrodyka, WNT, Warszawa 2000.
6. H. Bala, Korozja materiałów – teoria i praktyka, WIPMiFS, Częstochowa 2000.
7. M. Świerżewski, Chemiczne źródła prądu elektrycznego, Wydawnictwo SEP COSIW 2013.

Breakdown of average student's workload

	Hours	ECTS
Total workload	55	2,00
Classes requiring direct contact with the teacher	30	1,00
Student's own work (literature studies, preparation for laboratory classes/ tutorials, preparation for tests/exam, project preparation)	25	1,00