COURSE DESCRIPTION CARD - SYLLABUS

Course name
Electrochemistry [S1Elmob1>ECH2]

Course

Field of study
Electromobility

Year/Semester
2/3

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
0

Laboratory classes
30

Other
0

Tutorials
0

Projects/seminars
0

Number of credit points

3,00

Coordinators

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Lecturers

Prerequisites

The student has a basic knowledge of chemistry, physics and mathematics acquired at high school. The student has knowledge of the basics of electrochemistry acquired during the course. 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 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
Student can, when formulating and solving tasks related to electromobility, see their systemic and non-technical aspects, including environmental, economic and legal

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. Ongoing control of knowledge and skills during laboratory exercises.
2. Assessment of oral and written answers on the issues related to the laboratory exercise.

Programme content

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

Course topics

1. fundamentals of electrochemistry.
(a) basic concepts of chemistry and electrochemistry.
(b) valence of elements
(c) calculation the concentrations of solution
d) nomenclature of acids, bases and salts
2. mechanism and kinetics of electrode processes.
(a) oxidation and reduction in electrochemical processes
(b)electrolyzer and galvanic cell
(c) Faraday's law
d) computational tasks with 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; principle of operation, construction, design, characteristics and operation.
(a) calculus tasks for calculating the charge and energy of chemical current sources
6. lithium-ion cells.
(a) principle of operation
(b) construction and types of Li-ion cells
(c) electrode materials and electrolytes
7. nickel-hydride cells.

(a) principle of operation
b) construction and types of Ni-MH batteries
(c) electrode materials
8. lead-acid cells.
a) principle of operation
b) construction and types of lead-acid batteries
(c) electrode materials
9. supercapacitors.
(a) principle of operation
(b) construction and types of capacitors
-double electrical layer
-asymmetric
-hybrid
(c) electrode materials and electrolytes

Teaching methods

Laboratory classes

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	80	3,00
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)	50	2,00