Syllabus

Kursbeschreibung

Titel der Lehrveranstaltung	Electrochemical energy storage and conversion
Code der Lehrveranstaltung	45534
Zusätzlicher Titel der Lehrveranstaltung	
Wissenschaftlich-disziplinärer Bereich	ICHI-01/A
Sprache	Englisch
Studiengang	Master in Energie-Ingenieurwissenschaften
Andere Studiengänge (gem. Lehrveranstaltung)	
Dozenten/Dozentinnen	Dott. Narges Ataollahi, Narges.Ataollahi@unibz.it https://www.unibz.it/en/faculties/engineering/academic-staff/person/46627
Wissensch. Mitarbeiter/Mitarbeiterin	
Semester	Zweites Semester
Studienjahr/e	2
KP	6
Vorlesungsstunden	60
Laboratoriumsstunden	0
Stunden für individuelles Studium	90
Vorgesehene Sprechzeiten	
Inhaltsangabe	To equip students with a comprehensive understanding of the scientific and engineering principles behind modern electrochemical systems used for energy storage and conversion. Through lectures and laboratory work, students will develop theoretical and practical competencies in the design, analysis, and assessment of technologies such as batteries, fuel cells, electrolyzers and supercapacitors. The course prepares students to apply this

	knowledge in both research and industrial contexts, with a focus on solving real-world energy challenges using electrochemical solutions.
Themen der Lehrveranstaltung	This course covers the principles of electrochemical energy production, storage, and conversion. Main topics include:(i) the study of equivalent circuits, (ii) thermodynamics, (iii) reaction kinetics, (iv) transport phenomena, (v) hydrogen production and use; (vi) applications to batteries, fuel cells, electrolyzers and supercapacitors.
Stichwörter	Electrochemical Energy Applications, Batteries, Fuel cells, Electrolyzers, Hydrogen
Empfohlene Voraussetzungen	General chemistry- Physics: thermodynamics.
Propädeutische Lehrveranstaltungen	
Unterrichtsform	Frontal lectures and Laboratory.
Anwesenheitspflicht	Laboratory lessons are mandatory.
Spezifische Bildungsziele und erwartete Lernergebnisse	Knowledge and understanding: profound and detailed scientific knowledge and understanding of the principles of equilibrium and non-equilibrium electrochemistry Applying Knowledge and understanding: profound and detailed scientific knowledge of the main electrochemical energy conversion and storage methods Making judgments: skills and problem-solving capacity to analyze problems of electrochemical energy conversion and storage Communication skills: ability to structure and prepare scientific and technical documentation describing project activities Learning skills: ability to independently keep up to date with developments in the most important areas of electrochemical energy conversion and storage.
Spezifisches Bildungsziel und erwartete Lernergebnisse (zusätzliche Informationen)	

Art der Prüfung	Evaluation of written reports on lab experiments and oral examinations. The examination consists of either an oral test, or the discussion of a report written by the student on a topic which may be either freely chosen or chosen in agreement with the course lecturer. An alternative method for the exam is building an electrochemical device with given specifications (e.g. A zinc-carbon battery which provides a given amount of power for a given time) and discussion of the procedures used and the problems found.
Bewertungskriterien	Showing a sufficient knowledge of the topic and the ability to answer related questions.
Pflichtliteratur	One of the following books: Electrochemical Engineering, Thomas F. Fuller and John N. Harb. Water Electrolysis for Hydrogen Production, Pasquale Cavaliere Fundamentals of Electrochemistry, Bagotsky Electrochemistry for material science - Plieth Hydrogen Storage Technology Materials and Applications, ed. Lennie Klebanof Electrochemical Power Sources (Batteries, Fuel Cells and Supercapacitors, ed V.S Bagotsky, A.M Skundin,Y.M Volfkovich
Weiterführende Literatur	Other files dedicated to specific topics will be indicated or given during the course.
Weitere Informationen	Connections with other courses This course is connected with the course Advanced Materials for Energy Engineering (140487), which extends several topics introduced here, with a particular focus on the materials and devices used in energy conversion and storage systems. It's a natural continuation and highly recommended for students who want to explore more about device fabrication and material performance. Professional applications of the covered topics The topics covered are highly relevant for careers in the energy field, particularly in companies and research centers focused on batteries, fuel cells, electrolyzers, and supercapacitors. Students will gain both theoretical knowledge and practical skills useful for

	R&D, system design, and evaluating electrochemical devices. These are key areas in today's shift towards sustainable energy, like electric mobility, portable electronics, grid storage, and green hydrogen.
Ziele für nachhaltige Entwicklung (SDGs)	Bezahlbare und saubere Energie, Maßnahmen zum Klimaschutz, Nachhaltiger Konsum und Produktion, Industrie, Innovation und Infrastruktur