Module	***Theory of electrochemical energy storage***
Code	75061
Instruction language	German or English
ECTS credits	3
Credit hours	2
Duration	1 semester
Cycle	Summer semester
Coordinator	PD Dr. Birger Horstmann
Lecturer	PD Dr. Birger Horstmann
Allocation to study programmes	Physics M.Sc., elective module, 1st or 2nd semester Chemistry M.Sc., elective module, 1st – 3rd semester Chemical Engineering M. Sc., elective module
Formal prerequisites	
Recommended prerequisites	Basic knowledge in thermodynamics (Bachelor level)
Learning objectives	In the first part of the course, the fundamentals of theory-based modelling of electrochemical energy storage systems is taught. The theoretical part of the course is based on the fundamentals of thermodynamics; further knowledge of chemistry is not required. The modelling of electrochemical cells from a few atoms to the whole cell is shown. The processes in these systems are mainly described with partial differential equations, also called continuum modelling. The goal is the theory-based understanding of electrochemical energy storage, e.g. batteries, fuel cells, supercaps. In the second part of the course, current aspects of electrochemical systems are discussed with the students. The topics range from basic research on processes at electrochemical interfaces to the applied development of new energy storage systems. Students practice typical presentation techniques, which generally help in the preparation of talks.
Syllabus	Fundamentals and current problems of theory-based modelling of electrochemical energy storage devices.
Literature	• Newman J. and K. E. Thomas Alyea: Electrochemical Systems. 3 ed., John Wiley & Sons, Hoboken, New Jersey, 2004. • Bazant M.: Electrochemical Systems: Lecture Notes MIT, http://ocw.mit.edu/courses/chemical-engineering/10-626-electrochemical-energy-systems-spring-2014/lecture-notes/ (2014).
Teaching and learning methods	Lecture (1 h/week) and Seminar (1 h/week)
Workload	30 hours lecture (attendance time) 60 hours self-study and exam preparation Total: 90 hours
Assessment	Written or oral examination. Form and scope of the examination is determined and notified by the lecturer at the beginning of the course.

Examination	15061 Theory of Electrochemical Energy Storage
Grading procedure	The module grade is the examination grade.
Basis for	Research in the field of electrochemical energy storage