

SCIENTIFIC AND METHOD MODULES

Module name	Basics in Electrochemistry
Number	2016-B5
Aims	This module for physicists, chemists and biochemists introduces the basics in electrochemical methods, i.e. cyclic voltammetry, polarography, potentiometry. The doctoral researchers will be given an overview of applications within the fields of analytics, biocatalysis, (bio)electrosynthesis, and the development of electrochemical energy storages and fuel cells.
Basics	Foundations of redox processes, electric charge, electric potential and current, Nernst equation, Faraday's law, electronic and ionic conductivity, Design of spectroscopic experiment (source, monochromator, detector).
Contents	Basics in electrochemical methods, electrode processes, structure of interfacial region, types of electrochemical electrodes; electroanalytical methods: i.e. potentiometry, polarography, cyclic voltammetry, square wave voltammetry; Cyclic voltammetry as an indispensable tool in material's development, battery tests in full cells, electrochemical impedance spectroscopy, Study of activity and degradation phenomena, spectroelectrochemistry – combining spectroscopy and electrochemistry; cell design; X-ray absorption spectroscopy to unravel reaction mechanisms during real operation; applications: characterisation of multivalent systems, sensors, biosensors, bioelectrocatalysis, bioelectrochemical reactors.
Methods	Seminars
Type	Two-day block course
Date (month/year)	21-22 March 2016
Time	See program
Work load	15 hours presence/45 hours self-study
Examination	Written exam (Multiple Choice)
Credit points	2
Responsible scientists	E. Hey-Hawkins
Industrial partners	-
Recommendations for literature, e-learning	C. Lefrou, P. Fabry, and J.-C. Poignet. <i>Electrochemistry: The Basics, With Examples</i> , Heidelberg [u.a.]: Springer, 2012 . C. H. Hamann, A. Hamnett, W. Vielstich: <i>Electrochemistry</i> , Weinheim [u.a.], Wiley-VCH, 2007 . J. Wang: <i>Analytical Electrochemistry</i> , Hoboken, NJ: Wiley-VCH, 2006 . D. A. Skoog, F. J. Holler, S. R. Crouch: <i>Principles of Instrumental Analysis</i> , Belmont, Calif., Thomson, Brooks/Cole, 2007 . R. C. Alkire, D. M. Kolb, J. Lipkowski: <i>Electrocatalysis: Theoretical Foundations and Model Experiments</i> , Weinheim [u.a.], Wiley-VCH, 2013 . A. Wieckowski, J. Nørskov, S. Gottesfeld. <i>Fuel Cell Science: Theory, Fundamentals, and Biocatalysis</i> , Hoboken, Wiley-Blackwell, 2010 .

SCHEDULE for Module 2016-B5

Time	Lecturer	Programme	Location
Monday, 21 March 2016			
8:30 – 10:00	Dr. Falk Harnisch, UFZ Leipzig	(Re)calling fundamentals of electrochemistry	Johannisallee 29, SR 115
Coffee break			
10:15 – 11:45	Dr. Jürgen Mattusch, UFZ Leipzig	Introduction in electroanalytical methodology	Johannisallee 29, SR 115
11:45 – 12:30	Dr. Jürgen Mattusch, Petra Gläser	Demonstration experiments	Linnéstr. 3, Technikum-Analytikum
Lunch break			
14:00 – 15:30	Dr. Alexander Hildebrandt, TU Chemnitz	Spectroelectrochemistry for the characterization of mixed-valent molecules	Johannisallee 29, SR 115
Tuesday, 22 March 2016			
9:00 – 10:30	Dr. Falk Harnisch, UFZ Leipzig	Interfacing of biomolecules and electrodes	Johannisallee 29, SR 115
Coffee break			
10:45 – 12:15	Prof. Christina Roth, FU Berlin	The all-V redox flow battery (RFB): How to obtain more active and more stable materials?	Johannisallee 29, SR 115
Lunch break			
13:15 – 14:45	Prof. Christina Roth, FU Berlin	PEM fuel cells: In-operando X-ray absorption spectroscopy (XAS) to study the electrode reactions	Johannisallee 29, SR 115

Didactic elements:

Lecture, discussions, practical training – lab demonstration, etc.

Expected performance:

Active participation in discussions during lab demonstration etc.