

Fundamentals of Electrochemistry and Electrocatalysis

Instructor

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Timetable

April 2014 (*exact dates to be determined in relation to Easter holidays*)
3 hours per day over 5 days; a total of 15 hours.

Course Outline

Equilibrium Electrochemistry

Electrodes and half-reactions
Complete electrochemical cells and electrochemical reactions
Types of electrochemical cells (*galvanic and electrolytic*)
Reactions quotient and the Nernst equation; Gibbs energy of half-cell and complete cells; application of the Nernst equation
Cell potential (*electromotive force*); standard and non-standard cell potentials
Application of cell potentials

Electrode-Electrolyte Interface

Components of the electric double layer
Inner and outer Helmholtz layer
Helmholtz, Gouy-Chapmann, Stern and Grahame models
Potential distribution at the electrode-electrolyte interface (*inner potential, outer potential, surface potential*)

Dynamic Electrochemistry

Rate of charge transfer and the activation energy of the charge transfer
Derivation of the Butler-Volmer equation
Low and high overpotential limiting cases of the Butler-Volmer equation
Tafel relation
Electro-adsorption and electro-adsorption isotherms

Selected Electrochemical Methods

Chrono-amperometry
Chrono-potentiometry
Coulometry
Cyclic voltammetry
Polarization curves

Tafel plots
Electrochemical quartz-crystal nanobalance
Applied Aspects of Electrochemistry
Water electrolysis
Metal electrodeposition
Hydrogen oxidation and oxygen reduction reactions
Corrosion reactions
Rechargeable and non-rechargeable batteries

Reference Manual

1. E. Gileadi, *Physical Electrochemistry*, Wiley-VCH, Weinheim (2011).
2. P. Atkins, J. de Paule, *Physical Chemistry*, 9th Edition, W. H. Freeman & CO, New York (2010).
3. G. Jerkiewicz, Lecture Notes.

Evaluation

- (i) Mandatory participation in at least 80% of the lectures;
- (ii) Mini-examination (2 hrs) based entirely on the material covered in the lectures; date to be determined.

Termin	Dzień tygodnia	Godzina	Miejsce
09.04.2014	Środa	9.15 – 12.00	Minicentrum Konferencyjne (Luwr)
10.04.2014	Czwartek	9.15 – 12.00	Minicentrum Konferencyjne (Luwr)
11.04.2014	Piątek	9.15 – 12.00	Minicentrum Konferencyjne (Luwr)
14.04.2014	Poniedziałek	9.15 – 12.00	Minicentrum Konferencyjne (Luwr)
15.04.2014	Wtorek	9.15 – 12.00	Minicentrum Konferencyjne (Luwr)