

Course: Electrocatalysis & Electrosynthesis
Duration: 24 hours
Teacher(s): Abdirisak Ahmed Isse (8 hours)
Durante Christian (8 hours)
Marco Fantin (8 hours)

Curriculum: Chemical Sciences

Description:

Introduction to electrochemical systems

conductors, interfacial potentials, double layer structure, electrode potentials, polarization, ideal polarized and non-polarizable electrodes.

Electrosynthesis

General cell designs, diaphragm materials, electrode materials, pretreatment and activation of electrode materials, reference electrodes, solvents and electrolytes, potentiostatic and galvanostic modes of electrolysis, figures of merit of electrolysis.

Electrochemical kinetics

kinetics of electron transfer at electrodes, Butler-Volmer equation; limiting cases of low and high overpotentials; effect of mass-transfer; Fick's laws of diffusion and their applications in electrochemistry; diffusion overpotential.

Electrochemical techniques

electrochemical methods in three- and four-electrode cell configurations; cyclic voltammetry: reversible, quasi-reversible and irreversible systems; effect of chemical reactions coupled with electron transfer(s); rotating disk and ring disk electrode; electrochemical impedance spectroscopy; electrochemical probe microscopy.

Homogeneous electrocatalysis

electrocatalysis by metal complexes, electrocatalysis by organic mediators; some homogeneous electrocatalytic reactions of relevance in electrosynthesis, and in energy conversion and storage.

Heterogeneous electrocatalysis

microscopical view of an electrocatalytic surface; a quantitative descriptor for catalysis: the Volcano plot; examples of important electrocatalytic processes: hydrogen evolution reaction; water splitting; O₂ reduction reaction, CO₂ reduction, activation of carbon-halogen bonds, etc.

Would you be willing to offer the course on-line, in case interested students are abroad?

Yes.