

4.0 credits

30.0 h + 15.0 h

2q

Teacher(s) :	Proost Joris ;
Language :	Français
Place of the course	Louvain-la-Neuve
Main themes :	<p>The first part of the course provides an introduction to electrochemistry, based on previously developed concepts in chemical thermodynamics. The course starts with a description of aqueous, ionic solutions. Next, quantitative expressions are derived that establish the conditions of electrochemical equilibrium for redox reactions occurring at electrode surfaces. Finally, it is explained how, based on the concept of overpotential, classical rate theory can be applied to describe the kinetics of charge transfer at electrodes. Some typical current-potential regimes are discussed, as well as electrochemical characterisation methods and relevant technological applications.</p> <p>In the second part, both the chemical and the electrochemical thermodynamic and kinetic principles will be applied to the processing and the chemical stability of inorganic materials. Most materials in use by mankind are indeed unstable relative to their environment. It is shown that, for understanding and describing this chemical (in)stability, the same thermodynamic and kinetic principles can be used as the ones governing their extraction (corrosion is merely metal extraction in reverse). Specific attention will be given in this part to the construction and interpretation of relevant engineering diagrams (phase stability, predominance and transformation diagrams).</p>
Aims :	<p>The objective of this course is two-fold : in the first part, the principles of chemical equilibrium and chemical rate theory will be extended towards electrochemical equilibrium and electrochemical kinetics. The aim of the second part is to apply both the chemical and the electrochemical thermodynamic and kinetic principles towards the description of the processing and the chemical stability of inorganic materials.</p> <p><i>The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".</i></p>
Content :	<p>Part 1 : Introduction to electrochemistry description of ionic solutions and ion-solvent interactions (Debye-Hückel) structure of electrified interfaces (double layer, χ-potential) electrochemical free energy change, electrochemical equilibrium (Nernst), reversible half-reactions, electrochemical cells and redox series overpotentials and electrode kinetics (Butler-Volmer) characteristic current-potential curves and electrochemical measurements some electrode reactions and electrochemical systems of technological interest (electrocatalysis, electrodeposition, fuel cells, batteries)</p> <p>Part 2 : Introduction to the processing and chemical stability of inorganic materials Ellingham, Kellogg and Chaudron diagrams for predicting high temperature reactivity of inorganic materials in gaseous environments Pourbaix diagrams for predicting low temperature reactivity of inorganic materials in aqueous solutions chemical stability of processed metals (environmental behaviour, phase transformations, TTT diagrams) chemical principles of ceramic processing (phase diagrams, sintering diagrams, LaMer diagrams, colloid stability maps)</p> <p>Méthodes : ex-cathedra courses, homework problem sets, exercises</p>
Other infos :	Prerequisite MAPR 2310 : Thermodynamics of phase equilibria
Cycle and year of study :	> Bachelor in Engineering > Master [120] in Environmental Science and Management
Faculty or entity in charge:	FYKI