



Electrochemistry and Corrosion

Course Code	Course Num.	Course Name	Credit Hours	Lec.	Lab	Tut	Prerequisites
CHM	343	Electrochemistry and Corrosion	4	2	3	1	CHM 242

Objectives:

- To provide students with basics of electrochemical processes under standard and non-standard conditions.
- To familiarize students with the principles of some electrochemical techniques.
- To introduce corrosion and wear occurring to metals under different conditions.
- To give summary of different technologies are used to prevent or minimize corrosion.

Syllabus:

Introduction / Fundamental Concepts: Electrochemistry and Redox, Redox Review, Balancing Redox Reactions, Types of cells, Common Components, Electrolytic cells, Voltaic (Galvanic) Cells, Cell Potential. STANDARD POTENTIALS, Standard Reduction Potentials, E_{Ocell} and ΔG_{O} , Calculating E_{O} cell, Nernst equation, Concentration Cells. Batteries, Fuel Cells, Electrolysis, Stoichiometry, Faraday constant (F).

Practical Considerations: Electrochemical Cell, electroanalytical measurement, Potentiometric Technique, Potentiostatic Technique, voltammogram. Thermodynamics and Potentials. Ion-selective electrodes (ISE), glass electrodes, liquid membrane electrodes, solid-state electrodes, applications of ISEs. Steps in simple reactions, steps in complex reactions, electrode reaction pathway, reactions controlled by mass transport.

Potentiometry: Potential step experiments, potential sweep experiments. Reactions controlled by rate of electron transfer, electrical double layer. Reactions & Interfacial Properties: Cyclic voltammetry, Reversible Systems, Irreversible Systems, Quasi-reversible Systems, Applications, spectroelectrochemistry, electrochemiluminescence (ecl), scanning probe microscopy.

Electrode scanning tunneling microscopy (stm), atomic force microscopy (afm), scanning electrochemical microscopy (secm), electrochemical quartz crystal, microbalance (eqcm), impedance spectroscopy. Controlled potential techniques: Controlled potential, chronoamperometry, chronocoulometry, polarography, the ilkovic equation, pulse voltammetry, ac voltammetry, stripping analysis, flow analysis.

Chemical Corrosion: Electrochemical Corrosion, the Electrode Potential in Electrochemical Cells. Types of Electrochemical Corrosion, Protection Against Electrochemical Corrosion

Textbook:

Wang, Joseph, Analytical Electrochemistry, 3th edition, John Wiley & Sons, New Jersey, 2006.

References:

1. Donald R. Askeland – Pradeep P. Phulé, The Science and Engineering of Materials, 4th ed. (req. for corrosion part, Chapter 22)
2. A. J. Bard and L. R. Faulkner, Electrochemical Methods: Fundamentals and Applications, 2nd Ed., John Wiley & Sons, New York, 2001, ISBN: 0-471-04372-9.

