UNIVERSITI TEKNOLOGI MARA

CMT555: ELECTROCHEMISTRY AND CORROSION SCIENCE

Course Name (English)	ELECTROCHEMISTRY AND CORROSION SCIENCE APPROVED
Course Code	CMT555
MQF Credit	4
Course Description	The course is aimed at giving the student a wide overall spectrum on the industrial aspects of corrosion science, including corrosion behavior and corrosion protection of metals.
Transferable Skills	communication skills, teamwork skills, problem-solving skills.
Teaching Methodologies	Lectures, Lab Work
CLO	CLO1 Explain the concept of electrochemistry and corrosion science CLO2 Apply kinetics of corrosion equations in corrosion rate calculations CLO3 Employ thermodynamics, electrochemical processes governing the corrosion behavior of metals and applications of corrosion prevention/protection techniques in industrial operations CLO4 Demonstrate the methods of effective corrosion prevention and the use of electrochemical cell in corrosion study, interpret the experimental data and report experimental findings
Pre-Requisite Courses	No course recommendations

Topics
1. Electrochemical Nature of Aqueous Corrosion 1.1) 1.1 Electrochemical cells 1.2) 1.1.1 Components of a cells 1.3) 1.1.2 Conventional representation of a cell 1.4) 1.1.3 Potentials of cells and electrodes 1.5) 1.2 Electrochemical Thermodynamics 1.6) 1.2.1 Work and free energy 1.7) 1.2.2 Standard electrode potentials 1.8) 1.2.3 Nernst equation 1.9) 1.2.4 Equilibrium constant 1.10) 1.2.5 Solubility constant 1.11) 1.3 Potential/pH (Pourbaix) diagram 1.12) 1.3.1 Introduction – uses and limitation 1.13) 1.3.2 Water and dissolved oxygen 1.14) 1.3.3 Construction of aluminium
2. Electrolyte Conductance 2.1) 2.1 Introduction to conductance of electrolyte 2.2) 2.2 Theory of ionic conductance 2.3) 2.2.1 Weak electrolytes: The Arhenius theory and Ostwald's dilution law 2.4) 2.2.2 Strong electrolytes: Debye-Huckel theory 2.5) 2.3 Molar conductivities 2.6) 2.4 Molar conductivities at infinite dilution, Kohlrausch's law and Ionic molar conductivities 2.7) 2.5 Degree of dissociation 2.8) 2.6 Ionic equilibia: Equilibium constant and solubility products

3. Introduction to Corrosion
3.1) 3.1 Rusting of iron
3.2) 3.2 Types of corrosion
3.3) 3.2.1 General Corrosion
3.4) 3.2.2 Localized Corrosion
3.5) 3.2.2.1 Pitting corrosion
3.6) 3.2.2.2 Crevice corrosion
3.7) 3.2.2.3 Filiform corrosion
3.8) 3.2.3 Galvanic corrosion
3.9) 3.2.4 Cracking Phenomena
3.10) 3.2.4.1 Stress corrosion cracking
3.11) 3.2.4.2 Hydrogen embrittlement
3.12) 3.2.5 Velocity Phenomena
3.13) 3.2.5.1 Erosion corrosion
3.14) 3.2.5.2 Cavitation corrosion
3.15) 3.2.5.3 Impingement corrosion
3.16)
3.17) 3.2.6 Integranular corrosion
3.18) 3.2.7 Dealloying

4. Electrochemical Kinetics of Corrosion
4.1) 4.1 Introduction
4.2) 4.1.1 Faraday's law
4.3) 4.1.2 Exchange current density
4.4) 4.2 Electrochemical polarization
4.5) 4.2.1 Activation polarization
4.6) 4.2.2 Concentration polarization
4.7) 4.2.3 Combined polarization
4.8) 4.3 Mixed potential theory
4.9) 4.3.1 Corrosion potential and current density
4.10) 4.3.2 The E vs log i diagram
4.11) 4.4 Experimental polarization curve
4.12) 4.4.1 Cathodic polarization
4.13) 4.4.2 Anodic polarization
4.14) 4.4.3 Tafel extrapolation

5. Corrosion Prevention and Control
5.1) 4.1 Material selection and design
5.2) 4.2 Alteration of environment
5.3) 4.3 Cathodic and anodic protection
5.4) 4.4 Protective coatings
5.5) 4.4.1 Metallic coatings
5.6) 4.4.2 Organic coatings

6. Corrosion Inhibitors
6.1) 6.1 Definition of corrosion inhibitor
6.2) 6.2 Types of inhibitors
6.3) 6.2.1 Anodic inhibitors
6.4) 6.2.2 Cathodic inhibitors
6.5) 6.2.3 Mixed inhibitors
6.6) 6.3 Inhibitor's efficiency

7. Passivation
7.1) 7.1 Passive film
7.2) 7.2 Passive potential
7.3) 7.3 Trans-passive state

Assessment Breakdown	%
Continuous Assessment	100.00%

Details of Continuous Assessment

Assessment Type	Assessment Description	% of Total Mark	CLO
Assignment	One assignment	10%	CLO3
Quiz	Cumulative of two quizzes	20%	CLO1
Test	Cumulative of two tests	50%	CLO2
Written Report	Five lab reports (Experiment 1-5)	20%	CLO4

Reading List

Recommended Text

- **Mars G. Fontana, *Corrosion engineering*, MacGraw-Hill, New York**
- **Denny A. Jones, *Principles and Prevention of Corrosion*, Macmillan, New York.**
- **Zaki Ahmad, *Principles of Corrosion Engineering and Corrosion Control*, Butterworth-Heinemann**

Article/Paper List: This Course does not have any article/paper resources

Other References: This Course does not have any other resources