

Corrosion of Metals

MatSE 445, Fall 2020

Instructor: Professor Shen J. Dillon
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Meeting Location:
Class: MWF 1:00-1:50 PM Online

Teaching Assistants:

Office hours: Shen Dillon: By appointment

Text Book: Principles and Prevention of Corrosion, D. Jones, 2nd edition

Grading:	Homework problems:	15%
	Mid-term Exam:	25%
	Final Exam:	30%
	Class Project	30%

Course Objectives

This course will focus on provide a general introduction to corrosion by providing a discussion of the underlying thermodynamics and kinetics or the process, describing techniques for characterizing corrosion, discussion example corrosion problems, and introducing some approaches to suppressing corrosion. The class will mainly address corrosion of metals and emphasize corrosion in aqueous environments.

Pre-requisites

It will be assumed that students have a general understanding of the thermodynamics and kinetics of reactions as well as basic understanding of the structure and chemistry of crystalline materials.

Exams

Due to COVID-19, the exams will most likely be take home style exams.

Piazza

Piazza is available for questions, particularly those that may be of interest to others in the class.

Tentative Schedule

This schedule is subject to changes, which will be updated on compass along with a notice associated with the change.

Date	Video Lectures	Reading
August		
26	Ch. 1: Introduction & Motivation	
28	Ch. 1: Types of Corrosion	1-39
31	Ch. 2: EMF and Reaction Direction	
September		
2	Ch. 2: Reference States and Nernst Eq.	
4	Ch. 2: P, T, μ effects	40-50
7	Ch. 3: Faraday's law and Reaction Kinetics	
9	Ch. 3: Reversible and Irreversible Electrodes	
11	Ch. 3 Butler-Volmer, Nernst, Current-Overpotential	
14		
16	Ch. 3: Exchange Current and Corrosion from Polarization Curves	
18	Ch. 3: Anodic/Cathodic Polarization	
21	Ch. 3: Electrochemical Methods	
23	Ch. 3: Electrochemical Impedance; circuits	65-74 , 143-162
25		
28	Ch. 3: Electrochemical Impedance; EChem	75-86
30	Ch. 4: Pourbaix Diagrams (from Ch. 2)	50-64
October		
2	Ch. 4: Passivation & Evans Diagram	86-108 , 116-142
5		
7	Midterm	
9	Ch. 4: Concentration Effects & Catalytic Cathode	
12	Ch. 4: Solute Effects and Galvanic Corrosion	168-198
14	Ch. 4: Corrosion Protection & Passivity	
16	Ch. 4: Stainless Steel & localized corrosion	199-232
19	Ch. 4: Localized Corrosion and Microbiology	372-381
21		
23	Ch. 5: Corrosion Control & Environment	
26	Ch. 5: Corrosion Control & Materials Selection	291-334
28		
30	Ch. 5: Alloy Specific Considerations	
November		
2	Ch. 5: Geometric Effects	Summarized from

		439-512
4		
6	Ch. 6: Stress Corrosion Cracking	
9	Ch. 6: Hydrogen Embrittlement	235-290
11	Oxidation	
13	Oxidation	408-438
16		
18	Case Studies	
20	Case Studies	
30	Case Studies	
December		
2	Case Studies	
4	Class Project	
7	Class Project	
9	Last Day of Class	
Final Exam		