ChE 565
Spring 2010

CORROSION ENGINEERING

Instructor: Dr. Eung Ha Cho, Professor, Chemical Engineering Department, College of Engineering and Mineral Resources
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Class: MWF 11:00-11:50 at ESB 449

Credit Hours: 3

Text Book: Principles and Prevention of Corrosion, Second Edition, by D. A. Jones, Prentice Hall, Upper Saddle River, NJ, 1996

Course Goals:

1. Students should be familiar with types of corrosion.
2. Students should understand the mechanisms of various types of corrosion.
3. Students should be able to construct Eh-pH diagrams.
4. Students should understand the concepts of polarization.
5. Students should be able to derive electro-kinetics equations such as Butler-Volmer equation and Tafel equation.
6. Students should explain some of the corrosion mechanisms using Evans diagrams.
7. Students should understand the galvanostatic and potentiostatic studies.
8. Students should understand polarization methods to measure corrosion rate.
9. Students should be able to explain the mechanisms of anodic and cathodic protections.
10. Students should understand other corrosion protection methods using coatings and inhibitors.

Course Policies:

1. There are no make-up exams.
2. All problem sets are due at the beginning of class or at the started time.
3. Any class canceled due to inclement weather will be rescheduled.
4. Assignments that are copied will receive no credit.

Social Justice:

West Virginia University is committed to social justice. I concur with that commitment and expect to maintain a positive learning environment based on open communication,

mutual respect, and nondiscrimination. Our University does not discriminate on the basis of race, sex, age, disability, religion, sexual orientation, color and national origin. Any suggestions as to how to further such a positive and open environment in this class will be appreciated and given serious consideration.

If you are a person with a disability and anticipate need of any type of accommodation in order to participate in this class, please advise me and make appropriate arrangement with Disability Services (293-6700).

Topics:

1. Corrosion, Its Technology and Evaluation (Chapter 1, 1 lecture)
   - A. Definition of Corrosion
   - B. Costs of Corrosion
   - C. Forms of Corrosion

2. Thermodynamics of Corrosion (Chapter 2, 3 lec.)
   - A. Electrochemical Potentials
   - B. Eh-pH Diagrams
   - C. Experimental Measurements of Potential

3. Kinetics of Corrosion (Chapter 3, 4 lec.)
   - A. Theory of Polarization
   - B. Mixed Potential Theory
   - C. Galvanostatic Polarization

4. Passivity (Chapter 4, 2 lec.)
   - A. Passive Films
   - B. Potentiostatic Polarization
   - C. Anodic Protection

5. Polarization Methods to Measure Corrosion Rate (Chapter 5, 2 lec.)
   - A. Tafel Extrapolation
   - B. Polarization Resistance Method

6. Galvanic and Concentration Cell Corrosion (Chapter 6, 3 lec.)
   - A. Galvanic Corrosion
   - B. Experimental Measurements
   - C. Prediction of Galvanic Corrosion Rate
   - D. Concentration Cells

7. Pitting and Crevice Corrosion (Chapter 7, 4 lec.)
   - A. Examination and Evaluation
   - B. Pitting Corrosion
   - C. Crevice Corrosion

8. Environmentally Induced Cracking
   (Chapter 8, 4 lec.)
   A. Stress Corrosion Cracking
   B. Corrosion Fatigue Cracking
   C. Hydrogen Induced Cracking
   D. Typical Cases of SCC
   E. Methods of Prevention
   F. Mechanisms of SCC

9. Effects of Metallurgical Structure on Corrosion
   (Chapter 9, 3 lec.)
   A. Intergranular Corrosion
   B. Weldment Corrosion
   C. Dealloying and Dezincfication

10. Corrosion in Selected Corrosive Environments (Chapter 11, 3 lec.)
   A. Water and Aqueous Solutions
   B. Sulfur-Bearing Solutions
   C. Soils
   D. Acid Process Streams
   E. Alkaline Process Streams

11. Atmospheric Corrosion and Elevated Temperature Oxidation
   (Chapter 12, 3 lec.)
   A. Atmospheric Corrosion
   B. Oxidation at Elevated Temperature
   C. Oxidation Rate
   D. Alloying

12. Cathodic Protection (Chapter 13, 4 lec.)
   A. Fundamentals
   B. Design Factors

13. Coatings and Inhibitors (Chapter 14, 3 lec.)
   A. Metallic Coatings
   B. Inhibitors

14. Materials Selections (Chapter 15, 2 lec.)
   A. Alloy Selection

Grading Plan:

Homework (7-10 assignments)	20%
Exam (3)	80%

Grades: The normal grading scale is

90-100 A
80-89 B
70-79 C