

ME F464 Corrosion Engineering (3 credits)
2006 Spring
University of Alaska Fairbanks, Mechanical Engineering

Catalog description:

Principles and forms of corrosion and factors that affect it. Methods of testing and measurement, control and prevention are examined.

Prerequisites: ME F334.

Text: Principles and Prevention of Corrosion by Denny A. Jones, Prentice Hall; 2nd edition (September 29, 1995), ISBN: 0133599930

Course objectives:

Upon completion, students should be able to:

1. Understand the principles of corrosion chemistry, including redox reactions, electrochemical cell voltage, electrode potential, Nernst equation, activation polarization, Tafel equation, concentration polarization, passivity, mixed potential theory, corrosion potential and corrosion current density. Know to predict the corrosion tendency of a metal or an alloy in a given environment and to estimate the corrosion rate using the Tafel kinetic parameters.
2. Understand various forms of corrosion, their relation to the metallurgical structures, and their mitigation measures.
3. Learn the corrosion measurement and monitoring methods, including the linear polarization, Tafel extrapolation, and AC impedance techniques.
4. Learn the characteristics of various corrosion environments and corrosion control measures, including material selection, equipment design, coatings and linings, corrosion inhibitors, and anodic and cathodic protections.
5. Learn the principles of high temperature corrosion and corrosion resistance of metals and alloys in a high temperature environment.

Topics covered:

Types of corrosion, electrochemical mechanism; Thermodynamics and corrosion tendency, electrode potentials; Potential-PH diagrams; Electrochemical kinetics and corrosion rates; Passivity; Pitting and crevice corrosion; Stress corrosion cracking, corrosion fatigue, hydrogen induced cracking; Corrosion in various aqueous environments; Atmospheric corrosion and soil corrosion, corrosion inhibition; High-temperature gas-metal reactions, dry and hot corrosion; Theory and practice of cathodic and anodic protection; Corrosion protection by metallic, ceramic and organic coatings; Corrosion prediction and testing, electrochemical Methods.

Class schedules: Mon & Wed 2pm – 3:30 pm @ DU 342

Office hours: by appointment

TA: Elena Teidelt (DU 351, (O) 474-5022, (H) 457-3268, ftaet@uaf.edu)

Course web site: http://www.faculty.uaf.edu/ffjz1/teaching/me464/me464_spring06.html

ABET Criteria 3 - Program Outcomes

This course helps students gain the following:

- (a) an ability to apply knowledge of mathematics, science, and engineering.
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data.
- (d) an ability to function on multi-disciplinary teams.
- (e) an ability to identify, formulate, and solve engineering problems.
- (g) an ability to communicate effectively.
- (i) a recognition of the need for, and an ability to engage in life-long learning.
- (j) a knowledge of contemporary issues.
- (l) an understanding of northern issues.

ABET Criteria 4 - Professional Component

This course meets the professional requirements through section (b) the one and one-half years of engineering topics, consisting of engineering sciences and engineering design appropriate to the student's field of study.

Grading:

Project report: 20%

Presentation: 5%

Homework: 15% (20% off pts for being late one day. No pts for over five days.)

Quizzes: 10% (10-minute quizzes will be given at the beginning of some classes.)

Exams: 50%

Important dates:

Feb. 27: Submission of project topic

Feb. 27: 1st mid-term (15%)

April 10: 2nd mid-term (15%)

April 24, 26: Presentation and submission of project report

May 8: Final (20%)

Prepared by: Dr. Jing Zhang (DU 323, 474-6135, ffjz1@uaf.edu)