

The University of Texas at Arlington
Materials Science and Engineering Department

Professor Meletis

MSE 4390/5330

Spring 2015

Fundamentals of Corrosion Science & Engineering

Course Mechanics

Instructor: Efstathios “Stathis” I. Meletis, Professor
Office: 231 Engineering Laboratory Building
Telephone: (817) 272-2398 / email: meletis@uta.edu
Office Hours: W, F: 1:30 – 2:30 pm or by appointment

Lecture Meetings: T, Th 3:30 – 4:50 pm, Room 138 COBA

Student Learning

Outcomes:

1. Students will learn the fundamental principles behind corrosion.
2. Students will be able to identify and understand the basic forms of aqueous and high temperature corrosion.
3. Students will be able to apply the corrosion principles in the materials selection process, protection from corrosion but also apply corrosion as a materials processing or “synthesis” technique.

Requirements: Introduction to materials science & engineering or equivalent course.

Project: A project is required dealing with selection of a specific research corrosion topic (MSE 5330) or problem in service (MSE 4390) involving a review with an extensive literature analysis and demonstrate mastery over the subject. The project involves a class presentation and a term paper.
Due Dates: Project topic selection (with instructor’s approval) before the Spring break; Class presentations: the last two weeks of classes; Term Paper: the last day of class.

Examinations: One mid-term (about in the middle of the semester) and a final examination.

Grading Basis:

Project (presentation 15%, term paper 30%):	45%
Midterm Exam:	25%
Final Exam:	30%

Grading Policy: ≥85%: A; 75-84: B; 60-74%: C; 50-59%: D; <50%: F

Attendance Policy: Students are allowed to miss up to 2 classes without a valid excuse.

Drop Policy: see UT Arlington drop policy.

Textbook: Denny A. Jones, *Principles and Prevention of CORROSION*, Prentice Hall, Second Edition, Upper Saddle River, NJ, 1996.

Additional References:

1. M.G. Fontana, *Corrosion Engineering*, 3rd Edition, McGraw-Hill, 1986.
2. J.C. Scully, *Fundamentals of Corrosion*, Pergamon Press, 1975.
3. J.M. West, *Basic Corrosion and Oxidation*, Wiley, 1980.

4. H.H. Uling, *Corrosion and Corrosion Control*, Wiley, 1983.
5. G. Wranglen, *An Introduction to Corrosion and Protection of Metals*, Halsted Press, 1972.
6. S. Evans, *The Corrosion and Oxidation of Metals*, Arnold, 1960.
7. M. Paunovic and M. Schlesinger, *Fundamentals of Electrochemical Deposition*, John Wiley & Sons, Inc., New York, 1998.
8. Myer Kutz, *Handbook of Environmental Degradation of Materials*, 2nd Edition, Elsevier, 2012.

Americans with Disabilities Act: The University of Texas at Arlington is on record as being committed to both the spirit and letter of all federal equal opportunity legislation, including the *Americans with Disabilities Act (ADA)*. All instructors at UT Arlington are required by law to provide "reasonable accommodations" to students with disabilities, so as not to discriminate on the basis of that disability. Any student requiring an accommodation for this course must provide the instructor with official documentation in the form of a letter certified by the staff in the Office for Students with Disabilities, University Hall 102. Only those students who have officially documented a need for an accommodation will have their request honored. Information regarding diagnostic criteria and policies for obtaining disability-based academic accommodations can be found at www.uta.edu/disability or by calling the Office for Students with Disabilities at (817) 272-3364.

Academic Integrity: It is the philosophy of The University of Texas at Arlington that academic dishonesty is a completely unacceptable mode of conduct and will not be tolerated in any form. All persons involved in academic dishonesty will be disciplined in accordance with University regulations and procedures. Discipline may include suspension or expulsion from the University. According to the UT System Regents' Rule 50101, §2.2, "Scholastic dishonesty includes but is not limited to cheating, plagiarism, collusion, the submission for credit of any work or materials that are attributable in whole or in part to another person, taking an examination for another person, any act designed to give unfair advantage to a student or the attempt to commit such acts."

Student Support Services Available: The University of Texas at Arlington provides a variety of resources and programs designed to help students develop academic skills, deal with personal situations, and better understand concepts and information related to their courses. These resources include tutoring, major-based learning centers, developmental education, advising and mentoring, personal counseling, and federally funded programs. For individualized referrals to resources for any reason, students may contact the Maverick Resource Hotline at 817-272-6107 or visit www.uta.edu/resources for more information.

Electronic Communication Policy: The University of Texas at Arlington has adopted the University "MavMail" address as the sole official means of communication with students. MavMail is used to remind students of important deadlines, advertise events and activities, and permit the University to conduct official transactions exclusively by electronic means. For example, important information concerning registration, financial aid, payment of bills, and graduation are now sent to students through the MavMail system. All students are assigned a MavMail account. ***Students are responsible for checking their MavMail regularly.*** Information about activating and using MavMail is available at <http://www.uta.edu/oit/email/>. There is no additional charge to students for using this account, and it remains active even after they graduate from UT Arlington.

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Course Outline

- I. Introduction to corrosion
- II. Corrosion Principles: Electrochemical Aspects, Environmental Effects.
- III. Modern Theory of Aqueous Corrosion: Thermodynamic Aspects, Pourbaix Diagrams, Electrode Potential, Electrode Kinetics, Passivity, Applications.
- IV. High Temperature Corrosion: Oxidation, High-Temperature Reactions, Mechanisms and Kinetics, High-Temperature Materials and Coatings.
- V. Forms of Corrosion: Galvanic, Concentration Cells, Pitting, Crevice, Intergranular, Erosion, Wear-Corrosion, Environmentally-Induced Cracking (Stress Corrosion Cracking, Hydrogen Embrittlement, Corrosion Fatigue).
- VI. Corrosion Protection and Prevention: Design and Materials Selection, Inhibitors, Cathodic and Anodic Protection, Coatings, Novel Surface Modification Techniques (Ion Plating, Surface Treatments, Laser Treatments and Alloying).
- VII. Corrosion Testing and Evaluation: Field Tests, Laboratory Tests, Polarization Methods to Measure Corrosion Rate and Characterize Corrosion Behavior.
- VIII. Case Histories and Corrosion Failure Analysis.
- IX. Fundamentals of Electrochemical Deposition.