

Electrochemistry and Corrosion of Materials

EMA 6938 Section 23397

Class Periods: MWF 8 (3:00 – 3:50pm)

Location: Turlington L005

Academic Term: Fall 2019

Instructor:

Prof. Simon Phillpot

sphil@mse.ufl.edu

352 846-3782

Office Hours: M and R, 9:35 – 10:25, Rhines 164. Other times by arrangement

Supervised Teaching Student:

Please contact through the Canvas website

- David Brown, grayshen@ufl.edu
 - Office Hours: W 1 -2 pm Rhines Library

Course Description

Mechanisms, energetics and kinetics of corrosion and degradation of engineering materials. Economic solutions to degradation problems based upon design and materials selection. (3 credit hours).

Course Pre-Requisites / Co-Requisites

None

Course Objectives

- a. to develop an understanding of environmental conditions and degradation mechanisms that drive the deterioration of engineering materials and what is necessary for prevention or control;
- b. to become familiar with traditional terminology, conventions and sources of materials degradation;
- c. to be able to identify contemporary issues in environmental degradation of materials and how to go about understanding degradation mechanisms, rates, control, etc. in these novel problems;
- d. to develop an understanding of the environmental and economic impact of materials and their degradation throughout their life cycle.

Materials and Supply Fees

None

Required Textbooks and Software

- Principles and Prevention of Corrosion
- Denny A. Jones
- 1996, 2nd Edition
- ISBN 0-13-359993-0

Recommended Materials

- Corrosion Engineering: Principles and Solved Problems
- Branko N. Popov
- 2015, 1st Edition
- ISBN 978-0-444-62722-3

You will also find your thermodynamics book (Atkins, Physical Chemistry or similar) useful, particularly in the early part of the course.

Course Schedule

This schedule is a guide. The dates of the exams are firm - exams will be 50 minutes during the class period. The dates of each quiz will be announced in class at least one class before it is given. Based on the progress we make in class, the lectures may move quickly or more slowly. The chapters refer to Jones book.

Week 1:	Introduction & Chemical Equilibrium /Ch. 1 (2 classes)
Week 2:	Chemical Thermodynamics/ Ch 2.1
Week 3:	Pourbaix Diagrams/ Ch 2.2 (2 classes)
Week 4:	Pourbaix Diagrams & Faradays Law/ Ch 2.2, 3.1
Week 5:	Exam Prep and Exam 1 ; Chemical Kinetics/ Ch 3.1.2
Week 6:	Chemical Kinetics and Tafel Diagrams/ Ch. 3.2, 3.3
Week 7:	Evans Diagrams & Oxidizers / Ch 3.3, 3.4 (2 classes)
Week 8:	Passivation /Ch 4.1-4.4
Week 9:	Passivation and Anodic Protection /Ch. 4.3
Week 10:	Exam Prep and Exam 2 ; Corrosion Experiments / Ch 5.1
Week 11:	Corrosion Experiments & Impedance Spectroscopy /Ch. 5.2 – 5.6
Week 12:	Galvanic, Pitting and Crevice Corrosion /Parts of Ch. 6 & 7
Week 13:	High Temperature Corrosion and Ellingham Diagrams (2 classes) / Ch. 12
Week 14:	Oxidation Mechanisms; Cathodic Protection Ch. 12, 13
Week 15:	Cathodic Protection (1 class) / Ch. 13
Week 16:	Exam Prep & Exam 3 (2 classes)

Three classes will be folded into this schedule on professionalism and engineering ethics.

Attendance Policy, Class Expectations, and Make-Up Policy

Attendance is **strongly** encouraged. Attendance will inevitably be reflected in the course grade. Cell phones should be turned off, or muted, prior to the start of class. Reading of newspapers, work on assignments for this or other classes, or other activities that are not part of the class are not allowed during lecture. Students who do not comply with these requirements or who behave disrespectfully or in a disorderly manner may be asked to leave the classroom and will not be allowed to make up quizzes or other assignments. It is acceptable to work together on HW; however, all solutions submitted must be the work of the student and may not be copied from another student or other resource. Late HW will be accepted after the deadline and until the solutions are posted, with the overall score reduced by 30%. No HW will be accepted after the solutions are posted. There will be 8 or more in-class quizzes at announced times with the best 6 scores counting to the grade; make-ups will not generally be available for quizzes. Missed exams will be scored as zeros unless an excused absence has been given by the instructor prior to the exam. Excused absences must be consistent with university policies in the undergraduate catalog (<https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx>) and require appropriate documentation.

We will use Kahoot for unannounced in-class activities throughout the semester. Please have a phone, tablet or laptop with you.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (~12)	4 points per problem*	20%

Quizzes (~8; with best 6 counting)	10 each	10%
1 st Exam	100	20%
Second Exam	100	20%
Third Exam	100	20%
Report(s)	10	10%
		100%

* Each HW problem will be given a score between 0 and 4: 4 (correct or essentially correct; A quality work); 3 (very substantially correct; B quality work); 2 (largely correct; C quality work); 1 (some progress made; D quality work); 0 (minimal progress or question not attempted; E quality work)

Grading Policy

Percent	Grade	Grade Points
92 - 100	A	4.00
88 – 91.9	A-	3.67
84 – 87.9	B+	3.33
80 – 83.9	B	3.00
76 – 79.9	B-	2.67
72 – 75.9	C+	2.33
68 – 71.9	C	2.00
65 – 67.9	C-	1.67
62 – 64.9	D+	1.33
59 – 61.9	D	1.00
56 – 58.9	D-	0.67
0 – 55.9	E	0.00

More information on UF grading policy may be found at:
<https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx>

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, <https://www.dso.ufl.edu/drc>) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at <https://evaluations.ufl.edu/evals>. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at <https://evaluations.ufl.edu/results/>.

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this

assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/>) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html>

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc>, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the **Office of Title IX Compliance**, located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/>.

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu.
<https://lss.at.ufl.edu/help.shtml>.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling.
<https://www.crc.ufl.edu/>.

Library Support, <http://cms.uflib.ufl.edu/ask>. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring.
<https://teachingcenter.ufl.edu/>.

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers.
<https://writing.ufl.edu/writing-studio/>.

Student Complaints Campus: https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process>.