Introduction to Nuclear Reactor Materials

ENU 6805 Section 15CF
Class Periods: M W F, 4, and 9:35AM-10:25AM
Location: Classroom location
Academic Term: Fall/Spring NNNN

Instructor:
Yong Yang
yongyang@ufl.edu
352-846-3791
Office Hours: Walk-in or appointment by email

Teaching Assistants:
Please contact through the Canvas website
N/A.

Course Description
Introduction to the materials used in nuclear energy systems and their response to the reactor environment. The majority of materials related issues encountered in the nuclear power plants are discussed in this course.

Course Pre-Requisites / Co-Requisites
Be specific and indicate if equivalent courses or instructor permission is relevant. This must match the catalog for approved courses

Course Objectives
To provide the students with a comprehensive knowledge on the types of materials used in nuclear reactors, their response to the reactor environments and most of the materials problems encountered in the operation of nuclear power reactors for energy production.

Materials and Supply Fees
None.

Required Textbooks and Software
No required textbook, and the course notes will be posted online.

Recommended Materials

- Fundamentals of Radiation Materials Science
  - Author: Gary Was
  - Publication: Springer
  - ISBN: 978-1-4939-3436-2

- Fundamental aspects of nuclear reactor fuel elements,
  - Author: Donald R. Orlander
  - Publication: University of Michigan Library
  - ISBN: 0870790315

- Nuclear Reactor Materials and Applications
  - Author: B. Ma
  - Publication: Springer
  - ISBN-10: 0442225598
  - ISBN-13: 978-0442225599

- Principles and prevention of corrosion, 2nd edition
  - Author: Denny A. Jones
  - Publication: Prentice Hall, 1996
  - ISBN: 0-13-359993-0
- Corrosion Engineering
  - Author: Branko N. Popov
  - Publication: Elsevier
  - ISBN:978-0-444-62722-3

Course Schedule

Introduction and Materials Basis

Week 1: Course Introduction, General Survey of Materials in Nuclear Reactors
Week 2: Materials Basis, crystal structure, point defects, dislocation, grain boundary
Week 3: Materials Basis, diffusion
Week 4 Materials Basis, mechanical properties

Radiation Damage

Week 5 Radiation Damage, defect production
Week 6 Radiation Damage, rate theory, SRIM and DPA calculation

Corrosion

Week 7 Corrosion, introduction and stability of materials
Week 8 Corrosion, thermodynamics and kinetics
Week 9 Passivity, galvanic corrosion, pitting, crevice corrosion,
Week 10 Stress corrosion cracking, and Irradiation Assisted SCC
Week 11 Corrosion in supercritical water, molten salt and liquid metals

Nuclear Fuels

Week 12 Nuclear fuels, introduction and overview
Week 13 Reactor fuels, fission yields, and fuel chemistry
Week 14 Densification, swelling, creep, and thermal analysis
Week 15: Fuel failure mechanism and performance evaluation

Attendance Policy, Class Expectations, and Make-Up Policy

Proper behavior in class is required, eating, texting, chatting, or other activities that are not part of the class are not allowed. Students who do not comply with these requirements or who behave disorderly or disrespectfully may be asked to leave the classroom. Cell phones and other electronic devices must be completely silence or turned off.

Attendance is required and will be monitored using signup sheets, and your attendance records will be available on Canvas. Five or more un-excused absences will result in a deduction of 20 points from your final grade.

Excused absences are consistent with university policies in the undergraduate catalog (https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx) and require appropriate documentation.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade

Homework Sets (3)	100 each	30%
In Class Exam #1	100	15%
In Class Exam #2	100	15%
In Class Exam #3	100	15%
Final paper and presentation	100	25%
		100%

Grading Policy

The following is given as an example only.

Percent	Grade	Grade Points
90.0 - 100.0	A	4.00
87.0 - 89.9	A-	3.67
84.0 - 86.9	B+	3.33
81.0 – 83.9	B	3.00
78.0 - 80.9	B-	2.67
75.0 - 79.9	C+	2.33
72.0 – 74.9	C	2.00
69.0 - 71.9	C-	1.67
66.0 - 68.9	D+	1.33
63.0 - 65.9	D	1.00
60.0 - 62.9	D-	0.67
0 - 59.9	E	0.00

More information on UF grading policy may be found at:
http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades

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://www.dso.ufl.edu/sccr/process/student-conduct-honor-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 suppor*t*, 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.