

Introduction to Nuclear Reactor Materials

ENU 6805 Section 15CF

Class Periods: T: 10:40 AM-11:30 AM, R: 10:40 AM-12:35 PM

Location: FLG 0275 (T), UST 0108 (R)

Academic Term: Fall

Instructor:

Yong Yang

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352-846-3791

Office Hours: Monday, 1:15-3pm (Rhines 202A), or zoom with appointment

Teaching Assistant/Peer Mentor/Supervised Teaching Student:

None

Course Description

An introduction to the materials used in nuclear energy systems and their response to the reactor environment. This course covers the majority of materials-related issues encountered in nuclear power plants.

Course Pre-Requisites / Co-Requisites

None.

Course Objectives

To equip the students with comprehensive knowledge of the types of materials used in nuclear reactors, their response to the reactor environments, and the common materials problems encountered during 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

Required Computer

Recommended Computer Specifications: <https://it.ufl.edu/get-help/student-computer-recommendations/>
 HWCoe Computer Requirements: <https://www.eng.ufl.edu/students/advising/fall-semester-checklist/computer-requirements/>

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](#)

Important Dates

<Oct 3> **Quiz 1 (50 mins, in class)**
 <Nov 7> **Quiz 2 (50 mins, in class)**
 <Dec 2> **Quiz 3 (50 mins, in class)**
 <Dec 3> **Recorded final presentations (upload to a shared folder)**

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

Percent	Grade	Grade Points
94.0 - 100	A	4.00
91.0 - 93.9	A-	3.67
87.0 - 90.9	B+	3.33
84.0 - 86.9	B	3.00
81.0 - 83.9	B-	2.67
77.0 - 80.9	C+	2.33
74.0 - 76.9	C	2.00
71.0 - 73.9	C-	1.67
67.0 - 70.9	D+	1.33
64.0 - 66.9	D	1.00
60.0 - 63.9	D-	0.67
0 - 59.9	E	0.00

Academic Policies & Resources

To support consistent and accessible communication of university-wide student resources, instructors must include this link to academic policies and campus resources: <https://go.ufl.edu/syllabuspolices>. Instructor-specific guidelines for courses must accommodate these policies.

Attendance Policy, Class Expectations, and Make-Up Policy

Proper behavior in class is required. Activities such as eating, texting, chatting, or any other non-class-related activities 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 mandatory and will be monitored using signup sheets. Attendance records will be available on Canvas. Three or more unexcused absences will result in a deduction of 10 points from your final grade.

Excused absences must be consistent with university policies in the Graduate Catalog (<https://gradcatalog.ufl.edu/graduate/regulations/>) and require appropriate documentation. Additional information can be found here: <https://gradcatalog.ufl.edu/graduate/regulations/>.

Commitment to a Positive Learning Environment

The Herbert Wertheim College of Engineering values varied perspectives and lived experiences within our community and is committed to supporting the University's core values.

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 Coordinator
- HWCoe Human Resources, 352-392-0904, student-support-hr@eng.ufl.edu
- Pam Dickrell, Associate Dean of Student Affairs, 352-392-2177, pld@ufl.edu