

Nuclear Fuels and Materials Laboratory
ENU 6845L
Class Periods: T 8:30 AM - 11:30 PM
Location: Varied, laboratories on campus
Academic Term: Fall 2023

Instructor:

Dr. Assel Aitkaliyeva

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352-846-3778

Office hours: T: 3:30-4:30PM, R: 2:00-3:00 PM, and by appointment

Catalog Description

This course provides a background on the design of irradiation experiments and postirradiation examinations (PIE) needed to understand the behavior of nuclear fuels and materials. This laboratory class is designed to provide students with hands-on experience on state-of-the-art characterization instrumentation, sample preparation and handling, and safe radiological work practices.

Course Objectives

The overall objective of the course is to enable the students (the majority of which may work directly in the nuclear materials area in the future) understand the issues associated with materials degradation in nuclear reactors, recognize the flow of postirradiation examinations (both nondestructive and destructive), identify suitability of individual techniques for problem of interest, and be able to discuss PIE flow with others who do not have the appropriate background. Successful students at the end of the course will have:

- A basic understanding of the relationship between material microstructure and macroscopic behavior of nuclear fuels and materials.
- A basic understanding of the characterization tools available to conduct microstructural characterization of nuclear materials

Textbooks Required

None required. If you have not taken ENU4800 or ENU6805, recommended reading material includes the following:

Recommended Materials to Assist with Understanding Course Objectives

- Fundamentals of Radiation Materials Science, G. Was
- Fundamental aspects of nuclear reactor fuel elements, D. R. Olander
- Nuclear Reactor Materials and Applications by B. Ma

Recommended Texts and Support to Assist with Writing

- The Mayfield Handbook of Technical and Scientific Writing (available at <http://www.mhhe.com/mayfieldpub/tsw/toc.htm>). *Excellent resource and free!*
- The University of Florida Reading and Writing Center is also available to help students become better readers and writers. More information (including operating hours) can be found at <http://www.at.ufl.edu/rwcenter>.

Course Schedule

Week 1: Designing an irradiation and PIE campaign

Week 2: Radiological work basics

Week 3: Radiological work basics and practical

Week 4: Hot cell operation

Week 5: Sample preparation and metallography

Week 6: Surface based characterization techniques: SEM and XRD

Week 7: Focused ion beam milling-based sample preparation

Week 8: Focused ion beam milling-based sample preparation

Week 9: Proposal writing and data analysis

Week 10: Transmission electron microscopy of defects

Week 11: Neutron radiography

Week 12: X-ray tomography

Week 13: Thermal property measurements

Week 14: Mechanical testing

Week 15: FDOT lab tour, corrosion and SCC

*schedule is subject to change based on instrument availability/functionality and other unforeseen circumstances. The instructor will notify students if changes occur and will hold make up sessions on a different day (to be agreed upon by all involved parties).

Proper attire and behavior in the laboratory

We will be working with radioactive materials and thus, eating, drinking, and chewing in the laboratory are strictly prohibited. To attend the lab, you must be properly attired (i.e., must wear closed-toe shoes and pants, no shorts allowed). When entering radiological work area, you be provided a dosimeter that must be always worn (to be placed between neck and mid-section of the body). Upon leaving radiological area, you will be required to survey your hands, feet, and any item you brought into the lab.

Grading

| Assignment | Total Points | Percentage of Final Grade |
|---------------------|--------------|---------------------------|
| Attendance | 100 each | 25% |
| Writing assignments | 100 each | 50% |
| Video presentations | 100 each | 25% |
| | | 100% |

Grading Policy

The grading scale is as follows:

| Percent | Grade |
|---------|-------|
| 93-100 | A |
| 90-92 | A- |
| 87-89 | B+ |
| 83-86 | B |
| 80-82 | B- |
| 77-79 | C+ |
| 73-76 | C |
| 70-72 | C- |

| | |
|-------|----|
| 67-69 | D+ |
| 63-66 | D |
| 60-62 | D- |
| 0-59 | E |

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

Make-up Exam Policy

Make-up Exams and Laboratory Experiments are only allowed through prior requests or DOCUMENTED medical reasons. In cases where students will be out of town, a reasonable attempt to take the exam before the scheduled exam date will be performed.

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 professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/>. Students will be notified when the evaluation period opens and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluer.com/ufl/>. Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/>.

In-Class Recording

Students are allowed to record video or audio of class lectures. However, the purposes for which these recordings may be used are strictly controlled. The only allowable purposes are (1) for personal educational use, (2) in connection with a complaint to the university, or (3) as evidence in, or in preparation for, a criminal or civil proceeding. All other purposes are prohibited. Specifically, students may not publish recorded lectures without the written consent of the instructor.

A “class lecture” is an educational presentation intended to inform or teach enrolled students about a particular subject, including any instructor-led discussions that form part of the presentation, and delivered by any instructor hired or appointed by the University, or by a guest instructor, as part of a University of Florida course. A class lecture does not include lab sessions, student presentations, clinical presentations such as patient history, academic exercises involving solely student participation, assessments (quizzes, tests,

exams), field trips, private conversations between students in the class or between a student and the faculty or lecturer during a class session.

Publication without permission of the instructor is prohibited. To “publish” means to share, transmit, circulate, distribute, or provide access to a recording, regardless of format or medium, to another person (or persons), including but not limited to another student within the same class section. Additionally, a recording, or transcript of a recording, is considered published if it is posted on or uploaded to, in whole or in part, any media platform, including but not limited to social media, book, magazine, newspaper, leaflet, or third party note/tutoring services. A student who publishes a recording without written consent may be subject to a civil cause of action instituted by a person injured by the publication and/or discipline under UF Regulation 4.040 Student Honor Code and Student Conduct Code.

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.

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 at 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: <http://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>.