

Survey of Materials Analysis Techniques

EMA 6510 Sections 05F6, 2H75, 4463, 5356

Class Periods: T4 R4-5

Location: CSE E122

Academic Term: Fall 2019

Instructor:

Jiangeng Xue

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846-3775

Office Hours: Thursdays 1-2pm, RHN 237A, or by appointments

Teaching Assistants:

Please contact through the Canvas website

- N/A

Course Description

Principles and techniques used in characterization of materials. Chemical, microstructural, and surface analysis of materials; metals, ceramics, polymers, and semiconductor systems. 3 credits

Course Pre-Requisites / Co-Requisites

EMA3010 or equivalent

Course Objectives

- Grasp the principles and theory for general materials characterization techniques
- Understand the instrumentation requirement, set-up, and performance capabilities and limitations of these materials characterization techniques

Materials and Supply Fees

N/A

Required Textbooks and Software

- Encyclopedia of Materials Characterization: Surfaces, Interfaces, Thin Films, Ed. C. Richard Brundle, Charles A. Evans, Jr., and Shaun Wilson, 1992 by Butterworth-Heinemann (ISBN 978-0750691680). Electronic book available from ScienceDirect (with UF user authentication):
<http://www.sciencedirect.com/science/book/9780080523606>
- Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, by Y. Leng (2nd Ed.), 2013 by Wiley & Sons (ISBN 9783527334636). Electronic book available (with UF user authentication):
<https://ebookcentral.proquest.com/lib/ufl/detail.action?docID=1333091>

Recommended Materials

- Characterization of materials, by John B. Wachtman, with chapters on X-ray methods by Zwi H. Kalman (Course Reserve item in Marston Science Library: TA410 .W23 1993)
- Characterization of materials, by Elton N. Kaufmann (Course Reserve item in Marston Science Library: TA404.2 .K38 2003)
- The Physics and Chemistry of Materials, by Joel I. Gersten and Frederick W. Smith, Chapter 22 – Characterization of Materials (available online: ftp://ftp.wiley.com/public/sci_tech_med/materials)

Course Schedule

Tentative schedule and topics to be covered (subject to change):

Week 1: Introduction, Optical Microscopy (OM)

Week 2: Scanning Electron Microscopy (SEM)

Week 3: Transmission Electron Microscopy (TEM, incl. EDS/WDS, EELS)

Week 4:	Atomic Force Microscopy/Scanning Probe Microscopy (AFM/SPM)
Week 5:	Electron Spectroscopies (XPS, UPS, AES)
Week 6:	Optical Spectroscopies (Absorption/Transmission/Reflection)
Week 7:	Optical Spectroscopies (PL, FTIR, Raman)
Week 8:	Optical Spectroscopies (Ellipsometry)
Week 9:	Ion Techniques (SIMS)
Week 10:	Ion Techniques (ICP-MS, RBS, ISS)
Week 11:	X-ray Techniques (XRD)
Week 12:	X-ray Techniques (XRF, SAXS, GIXD)
Week 13:	X-ray Techniques (XRR, EXAFS)
Week 14:	Neutron Techniques (Diffraction, Reflection)
Week 15:	Review

Attendance Policy, Class Expectations, and Make-Up Policy

Class attendance is strongly encourage, though not required. Sections of this course are offered on UF EDGE. The lecture videos are available on the UF e-Learning (Canvas) website for all students (not just those who registered for the EDGE section) to review at any time. However, attendance is strongly encouraged for all non-EDGE students to enhance classroom learning and interaction. Electronic devices are allowed in classroom as long as they do not cause a distraction to other students. Cellular phones should be turned off or put to silent.

Excused absences must be in compliance with university policies in the Graduate Catalog (<http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance>) and require appropriate documentation. Except for emergencies, make-up exams are only allowed if requested at least one week before the regular exam time AND approved by the instructor. Make-up exams will differ from regularly-scheduled exams.

Evaluation of Grades

Assignment	Total Points	Percentage of Final Grade
Homework Sets (7)*	20 each	25%
Exams (3)	100 each	25% each
		100%

*Homework will be assigned on bi-weekly basis. The lowest graded (or non-submission) homework will be discarded in computing the final grade.

Grading Policy

The final letter grade will be assigned based on student's overall performance in the course. The following scale will be used as a guideline:

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

In order to graduate, graduate students must have an overall GPA and a major GPA of 3.00 or better (B or better). 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 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>.