

Course Syllabus

Chemistry 5210 Materials Characterization

Spring Semester, 2022, Mon. & Wed. 1:25–3:20p, Bruininks 530A

Prof. Aaron Massari, 245 Smith Hall, massari@umn.edu (<mailto:massari@umn.edu>)

This course covers modern tools and techniques for bulk and thin-film characterization. Topics will include particle scattering interactions, ion scattering, Auger electron spectroscopy, X-ray photoelectron spectroscopy, and electron and scanning probe microscopies.

Prerequisite: Undergraduate physical chemistry is recommended.

Textbooks (listed in order of relevance):

“Fundamentals of Nanoscale Film Analysis”, by T.L. Alford, L.C. Feldman, and J.W. Mayer, Springer Science & Business Media, Inc., 2007. **Available online, see Canvas**

“Transmission Electron Microscopy” by D.B. Williams and C.B. Carter, Springer Science & Business Media, Inc., 2009. **Available online, see Canvas**

“Surface Analysis – The Principal Techniques, 2nd Edition”, Edited by J.C. Vickerman and I.S. Gilmore, Wiley & Sons, Ltd., 2009. **Available online, see Canvas**

Other resources, handouts, and current literature will be announced in class.

TA: Zhihao Wu, wu000542@umn.edu (<mailto:wu000542@umn.edu>), **Office hour:** Mon 3:30-4:30 pm or by appt. **Zoom link** (<https://umn.zoom.us/j/98269110684?pwd=M1R2dkZMM0RsdnpKZ3V5R2ZpaDVXZz09>)

Grading: Final grades will be based upon performance on the items listed below. Registered students who do not complete the course will receive an F, unless they officially withdraw from the course. Incompletes will be given only when discussed with and approved by the instructors before the end of the semester.

- (25%) Homework sets: These will be assigned periodically throughout the semester.
- (75%) Three exams will be held during the semester worth 25% each.

Exam 1: February 23 (1:25p – 3:20p)

Exam 2: March 30 (1:25p – 3:20p)

Final Exam: May 7, (Sat) (8:00a – 10:00a)

Topics covered in this course

1. Rutherford Backscattering Spectrometry (RBS) and Ion Scattering Spectroscopy (ISS)
 - Chapters 2 and 3, Feldman
 - Chapters 1 and 6, Vickerman
2. Electron Scattering for Chemical Analysis (ESCA)/XPS and Auger
 - Chapters 10 and 12, Feldman
 - Chapter 3, Vickerman
3. Electron Microscopies
 - Williams and Carter, several chapters
4. Atomic Force Microscopy
 - Haugstad book and notes

Policy Statements

A full list of University classroom policies can be found here:

<https://policy.umn.edu/education> (<https://policy.umn.edu/education>)

Below are some of the sections that I feel are especially important.

Student Conduct Code:

The University seeks an environment that promotes academic achievement and integrity, that is protective of free inquiry, and that serves the educational mission of the University. Similarly, the University seeks a community that is free from violence, threats, and intimidation; that is respectful of the rights, opportunities, and welfare of students, faculty, staff, and guests of the University; and that does not threaten the physical or mental health or safety of members of the University community.

As a student at the University you are expected adhere to Board of Regents Policy: *Student Conduct Code*. To review the Student Conduct Code, please see:

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http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf
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Note that the conduct code specifically addresses disruptive classroom conduct, which means "engaging in behavior that substantially or repeatedly interrupts either the instructor's ability to teach or student learning. The classroom extends to any setting where a student is engaged in work toward academic credit or satisfaction of program-based requirements or related activities."

Use of Personal Electronic Devices in the Classroom:

Using personal electronic devices in the classroom setting can hinder instruction and learning, not only for the student using the device but also for other students in the class. To this end, the University establishes the right of each faculty member to determine if and how personal electronic devices are allowed to be used in the classroom. For complete information, please reference:

<https://policy.umn.edu/education/studentresp> (<https://policy.umn.edu/education/studentresp>)

Scholastic Dishonesty:

You are expected to do your own academic work and cite sources as necessary. Failing to do so is scholastic dishonesty. Scholastic dishonesty means plagiarizing; cheating on assignments or examinations; engaging in unauthorized collaboration on academic work; taking, acquiring, or using test materials without faculty permission; submitting false or incomplete records of academic achievement; acting alone or in cooperation with another to falsify records or to obtain dishonestly grades, honors, awards, or professional endorsement; altering, forging, or misusing a University academic record; or fabricating or falsifying data, research procedures, or data analysis. (Student Conduct Code:

http://regents.umn.edu/sites/regents.umn.edu/files/policies/Student_Conduct_Code.pdf
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If it is determined that a student has cheated, he or she may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please

see: <https://policy.umn.edu/education/instructorresp>
(<https://policy.umn.edu/education/instructorresp>)

If you have additional questions, please clarify with your instructor for the course. Your instructor can respond to your specific questions regarding what would constitute scholastic dishonesty in the context of a particular class-e.g., whether collaboration on assignments is permitted, requirements and methods for citing sources, if electronic aids are permitted or prohibited during an exam.

The Office for Student Conduct and Academic Integrity has compiled a useful list of Frequently Asked Questions pertaining to scholastic dishonesty:

<http://www1.umn.edu/oscai/integrity/student/index.html>

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The policy in this course is **zero tolerance**. The *minimum* action taken in a case of scholastic dishonesty in any portion of the work in this course will be a grade of F for the course.

Makeup Work for Legitimate Absences:

Students will not be penalized for absence during the semester due to unavoidable or legitimate circumstances. Such circumstances include verified illness, participation in intercollegiate athletic events, subpoenas, jury duty, military service, bereavement, and religious observances. Such circumstances do not include voting in local, state, or national elections. For complete information, please see:

<https://policy.umn.edu/education/makeupwork> <https://policy.umn.edu/education/makeupwork>

Incompletes: Students that have an excused absence from the Final Exam AND are passing the course based on all the work completed prior to the final exam may be eligible to receive a grade of "I" in the course. If these criteria are met, contact the instructor as soon as circumstances allow to discuss the possibility of an incomplete grade and the associated requirements for completion.

Student Mental Health and Stress Management: As a student you may experience a range of issues that can cause barriers to learning, such as strained relationships, increased anxiety, alcohol/drug problems, feeling down, difficulty concentrating and/or lack of motivation. These mental health concerns or stressful events may lead to diminished academic performance or reduce a student's ability to participate in daily activities. University of Minnesota services are available to assist you with addressing these and other concerns you may be experiencing. You can learn more about the broad range of confidential mental health services available on campus via

<http://www.mentalhealth.umn.edu/> <http://www.mentalhealth.umn.edu/>).

Sexual Harassment: The University policy on sexual harassment can be found at:

<http://regents.umn.edu/sites/default/files/policies/SexHarassment.pdf>

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Equity, Diversity, and Equal Opportunity: Policies on equity, diversity, and equal opportunity can be found at:

<https://diversity.umn.edu/eoaa/policiesanddirectives>

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University instructors are provided class rosters that list students' legal names. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this early in the semester so that I may make appropriate changes to how I might address you in or outside of class. I

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Disability Resource Center (DRC): Students with special needs should contact the DRC, <https://diversity.umn.edu/disability/> (<https://diversity.umn.edu/disability/>), which will arrange with the instructor information on how those needs shall be accommodated.