

SYLLABUS: Chemistry 5210 Materials Characterization Spring 2017
LEC 01:25pm-03:20pm MW, **Bruininks Hall 530A**

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The Course: This is a survey course in materials characterization. At the end of the semester, students should be able to make educated decisions regarding the selection of specific characterization methods for a particular research problem.

Objectives: At the end of the semester, a successful student should be able to:

- discuss relative advantages and disadvantages for techniques covered in class, including such issues as spatial limitations, vacuum requirements, ease of operation, specimen preparation, cost, common problems, and common availability
- identify and justify the selection of at least three techniques to assess a particular sample
- independently research and present a clear explanation of a characterization technique
- prepare a critical review of a recent publication that presents data obtained using a technique covered in our course

Primary Course Material: Technique descriptions in the recommended books; materials from the recent, peer-reviewed, scientific literature; demonstrations and tours of campus facilities (e.g., Characterization Facility). Technique discussions will focus on probe type, material response, typical specimen requirements, major limitations and advantages, and type of data that is and is not obtainable.

TEXTS:

“Fundamentals of Nanoscale Film Analysis”, by T.L. Alford, L.C. Feldman, and J.W. Mayer, Springer Science & Business Media, Inc., 2007. **Available online for free:**
<http://link.springer.com/book/10.1007/978-0-387-29261-8/page/1>

"Transmission Electron Microscopy" by D.B. Williams and C.B. Carter, Springer Science & Business Media, Inc., 2009. **Available online for free:**
<http://link.springer.com/book/10.1007/978-0-387-76501-3/page/1>

“Surface Analysis – The Principal Techniques, 2nd Edition”, Edited by J.C. Vickerman and I.S. Gilmore, Wiley & Sons, Ltd., 2009. **Available online for free:**
<http://onlinelibrary.wiley.com.ezp2.lib.umn.edu/book/10.1002/9780470721582>

Additional course content will be heavily drawn from resources like:

Encyclopedia of Materials Characterization: Surfaces, Interfaces, Thin Films
by Shaun Wilson (Editor), C. R. Brundle (Editor), Charles Evans (Editor)

800 pages; Publisher: Butterworth-Heinemann; ISBN: 0750691689; (August 1992)

This item is available electronically through www.lib.umn.edu

[UM TC Walter Sci/Eng Library Books \(Level F\) \(TA403 .L4335 2008 \)](#)

Concise Encyclopedia of Materials Characterization / 1993 by Cahn, R. W.

[UM TC Walter Sci/Eng Library Books \(Level F\) \(TA402 .C659 1992 \)](#)

Non-destructive Elemental Analysis / edited by Zeev B. Alfassi.

[UM TC Walter Sci/Eng Library Books \(Level F\) \(TA417.2 .N66x 2001 \)](#)

Elements of X-ray Diffraction / Cullity, B. D.

[UM TC Walter Sci/Eng Library Books \(Level F\) \(QC481 .C96 \)](#)

Functional nanostructures : processing, characterization, and applications; Seal, Sudipta.

[UM TC Walter Sci/Eng Library Books \(Level F\) \(TA418.9.N35 F847 2008 \)](#)

Surface Characterization Methods : Principles, Techniques, and Applications / Milling, A. J.

[UM TC Walter Sci/Eng Library Books \(Level F\) \(QD506 .S7837 1999 \)](#)

Microstructural Characterization of Materials / Brandon, D. G.

[UM TC Walter Sci/Eng Library Books \(Level F\) \(TA417.23 .B73 1999 \)](#)

Materials Science and Engineering: An Introduction / Callister, W. D.

[UM TC Walter Sci/Eng Library Books \(Level F\) \(Quarto TA403 .C23 2007 \)](#)

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

Graded Work:

Special Topics Presentation: Some class periods will begin with the 3-5 minute presentation of a recent journal article that highlights one technique covered in the previous class period followed by a five-minute discussion of the information presented. These will be team presentations, with teams composed of 2-3 students.

Students will be assigned to interdisciplinary teams of about three members to review a paper from the literature. A single review will be turned in by each team, and each member of the team will be assigned the same grade. After completing the review papers, team members will be asked to provide a qualitative assessment of the contributions of their peers. These assessments will count towards 20% of the final grade.

2 Review Papers:

ONE Team review paper: Students will be assigned to interdisciplinary teams of about three members to review a paper from the literature. A single review will be turned in by each team, and each member of the team will be assigned the same grade. After completing the review papers, team members will be asked to provide a qualitative assessment of the contributions of their peers. These assessments will count towards 20% of the final grade.

- 1. ONE Individual Review Paper:** Each student will individually prepare ONE review of a recent journal article that will be assigned two weeks before the due date. A single review will be turned in by each student, and students are expected to NOT discuss the paper with others.

Technique and Application Proposal: Hypothesis-driven proposal to apply a technique to characterize a sample relevant to YOUR research project(s). Students not currently engaged in a research project should come talk to Lee Penn about topic ideas.

Technique and Application Presentation: **8-10 minute presentation** presenting the hypothesis tested, the technique employed, the pros and cons of that technique, and correlative or validating techniques.

Oral Final Exam: Our official final exam time is 8:00-10:00am Wednesday, May 11. It is impossible that all students can be accommodated during that time, so additional periods will be scheduled during final exam week, taking into account the schedules of students in the course.

Reading Assignments and quizzes: Everyone will be expected to have completed reading assignments prior to lecture. We will occasionally have quizzes (often take-home) on the topics covered in reading assignments or in lecture.

Class Participation: A significant portion of this course will involve discussion, both during the discussion periods following a review presentation and during the course of each lecture and demonstration. *Every student is expected to be an active participant in this course.*

Students registered in this course must use the moodle site created for this class.

Things found on our course web page: the syllabus, class announcements, grades, weekly feedback assignments, and more.

The Moodle Site: Chem 5210 - Section 001 - Spr 2012 (this course)

Moodle assignments: Typically, these assignments will ask you to identify useful aspects of a demonstration or similar activity, make suggestions for improvements, give feedback for student presentations, and give feedback on various aspects of the course. You will NOT be graded on your answers. You will only be graded on your participation in this activity. If you complete these assignments in a thoughtful manner, you'll automatically earn a 100% in this portion of the course. I predict each assignment will take 10-15 minutes of your time.

Grades: *All grades will be recorded/reported using the Moodle site.*

The A-F and S-N grading systems will be used in this course. If you are taking the course on an S-N basis, to receive an S, you must earn a C- or better on the A-F scale. An incomplete (I) will be assigned only to students who have satisfied two requirements: 1) you must have received passing grades on all work up to the final exam and 2) you must contact me prior to the final exam due date - *no exceptions!*

Final Grade:	
Special Topics Presentation (or option):	10%
2 Review Papers:	10% each
Technique and Application Paper:	15%
Technique and Application Presentation:	15%
Final Exam:	30%
Class Participation:	5%
Quizzes and homework	5%

Policy Statements

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

http://www.policy.umn.edu/Policies/Education/Education/SYLLABUSREQUIREMENTS_APPA.html 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:
http://regents.umn.edu/sites/default/files/policies/Student_Conduct_Code.pdf.

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."

Preferred name and gender pronouns: If your preferred name does not match the one provided in class rosters, please note this, and other related information (e.g., gender pronouns), on your first-day-of-class notecard.

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: <http://policy.umn.edu/Policies/Education/Education/STUDENTRESP.html>.

Academic Honesty:

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/default/files/policies/Student_Conduct_Code.pdf)

If it is determined that a student has cheated, they may be given an "F" or an "N" for the course, and may face additional sanctions from the University. For additional information, please see: <http://policy.umn.edu/Policies/Education/Education/INSTRUCTORRESP.html>.

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>.

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.

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:

<http://policy.umn.edu/Policies/Education/Education/MAKEUPWORK.html>.

Sexual Harassment

"Sexual harassment" means unwelcome sexual advances, requests for sexual favors, and/or other verbal or physical conduct of a sexual nature. Such conduct has the purpose or effect of unreasonably interfering with an individual's work or academic performance or creating an intimidating, hostile, or offensive working or academic environment in any University activity or program. Such behavior is not acceptable in the University setting. For additional information, please consult Board of Regents Policy:

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

Equity, Diversity, Equal Opportunity, and Affirmative Action:

The University provides equal access to and opportunity in its programs and facilities, without regard to race, color, creed, religion, national origin, gender, age, marital status, disability, public assistance status, veteran status, sexual orientation, gender identity, or gender expression. For more information, please consult Board of Regents Policy:

http://regents.umn.edu/sites/default/files/policies/Equity_Diversity_EO_AA.pdf.

Disability Accommodations: Students with disabilities that affect their ability to participate fully in class or to meet all course requirements should bring this Lee Penn's attention as soon as possible so that appropriate accommodations can be arranged. If you have, or think you may have, a disability (e.g., mental health, attentional, learning, chronic health, sensory, or physical), please contact DS at 612-626-1333 to arrange a confidential discussion regarding equitable access and reasonable accommodations. Further information is available from Disabilities Services (<http://ds.umn.edu/>).

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 and may reduce your ability to participate in daily activities. University of Minnesota services are available to assist you. You can learn more about the broad range of confidential mental health services available on campus via the Student Mental Health Website: <http://www.mentalhealth.umn.edu>.