



ChEE 483/583: Introduction to Polymeric Materials **Fall 2018, Time TBD, Location TBD**

Instructor

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Prerequisites

CHEM 151/152, PHYS 141

Text

Hiemenz & Lodge *Polymer Chemistry* 2nd Edition
Available at the bookstore and on reserve at library

Supplemental Text

Cowie & Arrighi *Polymers: Chemistry & Physics of Modern Materials* 3rd Edition
On reserve at library

Description of Course and Course Objectives

The aim of this course is to develop a working understanding of the foundations of polymeric materials. Successful completion of this course will allow you to understand basic polymer chemistry, characterization of polymers, and polymer behavior. Topics covered include the structure of polymers, mechanisms of polymer synthesis, characterization methods (including calorimetric, mechanical, rheological, and X-ray-based techniques), and their electronic, mechanical, and thermodynamic properties. Special classes of polymers: engineering plastics, semiconducting polymers, photoresists, and polymers for medicine.

Learning Outcomes:

Successful completion of this course (ChEE 483/583) will allow the student to:

1. Understand the influence of molecular and micro structure on the properties of polymers
 - a. Differentiate between the structure and properties of homopolymers, block copolymers, random copolymers, graft polymers, and dendrimers
 - b. Understand influence of tacticity on polymer ordering and properties
2. Understand the initiation, propagation, and termination of common polymerization methods, including:
 - a. Step-growth
 - b. Chain-growth
 - c. Cationic/Anionic
 - d. Ring-opening
3. Select possible monomers for synthesis of polymers with desired molecular structure for common families of polymers such as polyamides, polyesters, polyimides, and polyurethanes
4. Characterize the properties of polymers, including:
 - a. Molecular weight
 - b. Glass and crystalline (when applicable) phase transitions
 - c. Bulk mechanical properties such as stress-strain behavior and viscoelasticity
 - d. Bulk optical and electronic properties

5. Apply knowledge to technologically advanced classes of polymers including conjugated polymers, ionic polymers, and biopolymers
6. **Graduate students** will apply understanding of the chemistry and characterization of properties to design a polymer to address a specific application, propose a general synthesis route (selection of polymer precursors), and select characterization methods appropriate to the material and application.

Absence and Class Participation Policy

The UA's policy concerning Class Attendance, Participation, and Administrative Drops is available at: <http://catalog.arizona.edu/policy/class-attendance-participation-and-administrative-drop>

The UA policy regarding absences for any sincerely held religious belief, observance or practice will be accommodated where reasonable, <http://policy.arizona.edu/human-resources/religious-accommodation-policy>.

Absences pre-approved by the UA Dean of Students (or Dean Designee) will be honored. See: <https://deanofstudents.arizona.edu/absences>

Participating in the course and attending lectures and other course events are vital to the learning process. As such, attendance is **strongly recommended** at all lectures and discussion section meetings. Students who miss class due to illness or emergency are required to bring documentation from their health-care provider or other relevant, professional third parties. Failure to submit third-party documentation will result in unexcused absences.

Course Communications

Official UA email address and/or D2L

Schedule and Exams

The course will be divided into three 4.5-week units. The chapters listed below are approximate.

- (1) **Chemistry** (Chapters 1-5): synthesis, kinetics, and molecular structure. **Exam 1: Fri 9/28**
- (2) **Materials** (Chapters 6-8, 13): thermodynamics, microstructure, characterization. **Exam 2: Fri 11/2**
- (3) **Mechanics** (Chapters 10-12): mechanical and thermal properties. **Exam 3: Fri 11/30**

There is no class on Mon 9/3 (Labor day), Fri 10/26 (Mid-semester study break), Wed 11/21, or Fri 11/23 (Thanksgiving)

The final exam is TBD, location TBD. The date and time of the final exam or project, along with links to the Final Exam Regulations, <https://www.registrar.arizona.edu/courses/final-examination-regulations-and-information>, and Final Exam Schedule, <http://www.registrar.arizona.edu/schedules/finals.htm>

Graduate students will deepen their understanding of the chemistry and characterization of polymers. These skills will be applied to a final paper in which the student will design a polymer to address a specific application, propose a general synthesis route (selection of polymer precursors), and select characterization methods appropriate to the material and application.

Dispute of Exam Grade Policy: You have **one week after I return exams** to the class to submit any regrade requests. If I regrade your exam, I will not only regrade the problem(s) you believe was/were incorrectly graded, but also the rest of the exam. *Sometimes my grading mistakes work in your favor, so it is entirely possible that you could end up with a lower grade after requesting a regrade.*

Homework

Homework for the quarter will be posted on D2L. **It is not due for a grade**, but it is recommended to develop a working understanding of the material. In addition to these "official" homework problems, there is a supplemental text listed above (Cowie & Arrighi) for which I have uploaded the solutions manual, in case you want additional practice. *Problems listed in my handwritten lecture notes refer to recommended problems in the supplemental text, not to the main text.*

Grading

Three midterm exams 20% each; final exam 40%. Course grades will be computed using two methods, and the higher of the two grades will be used as the final grade. In the first method, I will rank the class from top to bottom and distribute 30% As, 30% Bs, 30% Cs, 5% Ds, and 5% Es. In the second method, I will assign letter grades based on an absolute scale of the points earned in the course, as follows:

85 – 100	A
61 – 84.99	B
31 – 60.99	C
21 – 30.99	D
0 – 20.99	E

Graduate students will be graded on the same scale, with the addition of a final paper in which the student will design a polymer to address a specific application, propose a general synthesis route (selection of polymer precursors), and select characterization methods appropriate to the material and application.

Graduate students weighting as follows: three midterm exams 15% each; final exam 30%, and graded paper 25%.

Cheating: It is expected that students will do their own work. Copying other students or using unauthorized materials on the exam will result in a grade of 0.

Requests for incomplete (I) or withdrawal (W) must be made in accordance with University policies, which are available at <http://catalog.arizona.edu/policy/grades-and-grading-system#incomplete> and <http://catalog.arizona.edu/policy/grades-and-grading-system#Withdrawal> respectively.

Classroom Behavior Policy

To foster a positive learning environment, students and instructors have a shared responsibility. We want a safe, welcoming, and inclusive environment where all of us feel comfortable with each other and where we can challenge ourselves to succeed. To that end, our focus is on the tasks at hand and not on extraneous activities (e.g., texting, chatting, reading a newspaper, making phone calls, web surfing, etc.).

Students are asked to refrain from disruptive conversations with people sitting around them during lecture. Students observed engaging in disruptive activity will be asked to cease this behavior. Those who continue to disrupt the class will be asked to leave lecture or discussion and may be reported to the Dean of Students.

Threatening Behavior Policy

The UA Threatening Behavior by Students Policy prohibits threats of physical harm to any member of the University community, including to oneself. See <http://policy.arizona.edu/education-and-student-affairs/threatening-behavior-students>.

Accessibility and Accommodations

At the University of Arizona we strive to make learning experiences as accessible as possible. If you anticipate or experience physical or academic barriers based on disability or pregnancy, you are welcome to let me know so that we can discuss options. You are also encouraged to contact Disability Resources (520) 621-3268 to explore reasonable accommodation.

If our class meets at a campus location: Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

Code of Academic Integrity

Students are encouraged to share intellectual views and discuss freely the principles and applications of course materials. However, graded work/exercises must be the product of independent effort unless otherwise instructed. Students are expected to adhere to the UA Code of Academic Integrity as described in the UA General Catalog. See: <http://deanofstudents.arizona.edu/academic-integrity/students/academic-integrity>.

The University Libraries have some excellent tips for avoiding plagiarism, available at <http://www.library.arizona.edu/help/tutorials/plagiarism/index.html>.

Selling class notes and/or other course materials to other students or to a third party for resale is not permitted without the instructor's express written consent. Violations to this and other course rules are subject to the Code of Academic Integrity and may result in course sanctions. Additionally, students who use D2L or UA e-mail to sell or buy these copyrighted materials are subject to Code of Conduct Violations for misuse of student e-mail addresses. This conduct may also constitute copyright infringement.

UA Nondiscrimination and Anti-harassment Policy

The University is committed to creating and maintaining an environment free of discrimination; see <http://policy.arizona.edu/human-resources/nondiscrimination-and-anti-harassment-policy>

Our classroom is a place where everyone is encouraged to express well-formed opinions and their reasons for those opinions. We also want to create a tolerant and open environment where such opinions can be expressed without resorting to bullying or discrimination of others.

Additional Resources for Students

UA Academic policies and procedures are available at <http://catalog.arizona.edu/policies>

Student Assistance and Advocacy information is available at <http://deanofstudents.arizona.edu/student-assistance/students/student-assistance>

Confidentiality of Student Records

<http://www.registrar.arizona.edu/personal-information/family-educational-rights-and-privacy-act-1974-ferpa?topic=ferpa>

Subject to Change Statement

Information contained in the course syllabus, other than the grade and absence policy, may be subject to change with advanced notice, as deemed appropriate by the instructor.