CHEM 544: Advanced Topics in Organic Chemistry (Polymer Chemistry I)
Semester: Spring 2017
Credits: 2

Instructors: Dr. Rock Mancini, Fulmer Hall, Room 170, email: rmancini@wsu.edu

Prerequisites:
Undergraduate Students: A letter grade of B or better in CHEM 345, and MATH 170
Graduate Students: None

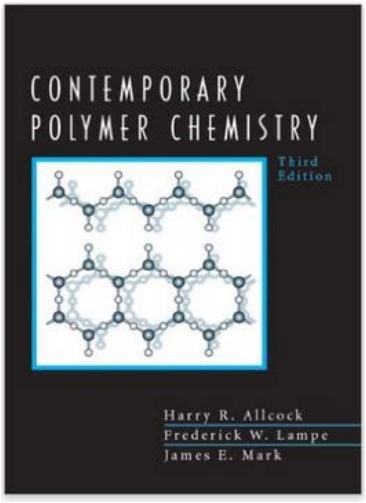
Contact and Office Hours:

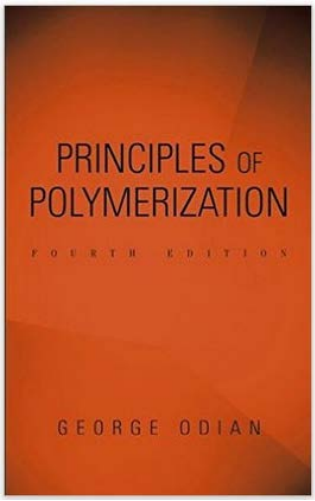
- M/W 12:00-1:00 pm (must email first) and by email appointment.
- Contact by email and put "CHEM 544" in the subject field.
- Include full name and student ID number in all correspondence.

Class Meeting Time and Place: Monday and Wednesday 11:10am-12:00pm Fulmer 432

Recommended **Texts:**

1. "Contemporary Polymer Chemistry" (Third Edition) by Harry R. Allcock, Frederick W. Lamp and James E. Mark
2. "Principles of Polymerization" (Fourth Edition) by George Odian





Both books are available used on amazon for a combined price of less than $100. Other editions are acceptable.

Lecture Course Description: The Chem 544 curriculum is based on learning synthetic organic polymer chemistry from a historical perspective. We will survey synthetic organic polymers currently used today and discuss mechanistic implications relevant to their manufacture, properties, and performance. Each week we will explore a different type of polymer or polymer characterization technique. Please consult the lecture topic outline section for a specific list. Students will also be expected to critique current literature (paper discussion), volunteer new ideas (ideation), and present an original polymer chemistry concept / project to the class (powerpoint miniproposal). Details for each of these can be found in the attached handouts.

Course Objectives and Student Learning Outcomes:

1) Recognize common organic polymers within the context of their application and historical significance.
2) Master polymerization mechanisms and plan the synthesis of a variety of polymers.
3) Use polymer characterization techniques to define synthetic organic polymers.
4) Use chemical intuition to determine structure-property relationships in synthetic organic polymers.
5) Critically examine current techniques and applications of synthetic organic polymers.
6) Collaboratively create, and publicly propose, new ideas related to polymer chemistry.

Assignments & Grading Policy.
1 Mid-Term (200 pts)
Final Exam (400 pts)
Contribution to paper discussions (100 pts)*
Contribution to ideation (100 pts)*
1 Powerpoint presentation of miniproposal (200 pts)*
Homework assignments will be provided on a bi-weekly basis, but will not count towards the final grade.

*see handouts for details and scoring rubric

Grade Scale: This course will use the following grade scale. Please note that it is not possible to receive a "D" grade. You must receive 50.0% of the points outlined above to pass the class. If your grade falls exactly on a cutoff (eg. 75.0), the higher grade (eg. B) will be used. Grades will not be rounded.

A	> 92.0 %
A-	89.5 - 92.0 %
B+	85.0 - 89.5 %
B	75.0 – 85.0 %
B-	69.5 - 75.0 %
C+	65.0 - 69.5 %
C	55.0 - 65.0 %
C-	50.0 % - 55.0 %
F	< 50.0 %

Late Policy: Late work of any kind will not receive credit. Exams must be turned in by **11:10am** on the day they are due. No exams will be accepted past the deadline for any reason. Failure to turn in an exam by the deadline will result in a 0.

Test Policy and Regrades:
Both the mid-term and final exams for this course are tentatively scheduled as take-home exams (subject to change without notice). It is expected that you will follow all instructions on the exam, especially those regarding the use of external resources and timing. You must sign the honor pledge on your exam to receive credit. Exam questions may be regraded if they are submitted with a paragraph explanation, however, it should be noted that upon requesting a regrade, the *entire exam* is subject to a regrade.

Test Schedule:
Mid-Term will be distributed on **FEBRUARY 15, 2017** in lecture and will be due on **FEBRUARY 22, 2017** at **11:10am**.
Final Exam will be distributed on **APRIL 26, 2017** in lecture and will be due back on **MAY 3, 2017** at **11:10am**.
If you miss the lecture where exams are distributed it is your responsibility to contact the instructor to obtain a copy.

Expectations for Student Effort:
For each hour of lecture students should expect to have a minimum of two hours of work outside of class. It is expected that all students will contribute to the best of their ability to all collaborative projects.

Students with Disabilities: Reasonable accommodations are available for students with a documented disability. If you have a disability and need accommodations to fully participate in this class, please either visit or call the Access Center (Washington Building 217; 509-335-3417) to schedule an appointment with an Access Advisor. All accommodations MUST be approved through the Access Center. For more information, contact a Disability Specialist.

Academic Integrity: For ideation and paper presentations, you are encouraged you to work with classmates on assignments. However, each student must turn in original work. No copying will be accepted. Students who violate WSU's Standards of Conduct for Students will receive an F as a final grade in this course, will not have the option to withdraw from the course, and will be reported to the Office Student Standards and Accountability. Cheating is defined in the Standards for Student Conduct WAC 504-26-010 (3). It is strongly suggested that you read and understand these definitions. There are take-home exams associated with this course; however, the same rules for academic integrity apply. You are NOT permitted to use an internet connected or other electronic devices (except where noted), or you will fail the exam and be reported as described above.

Safety Statement: "Classroom and campus safety are of paramount importance at Washington State University, and are the shared responsibility of the entire campus population. WSU urges students to follow the "Alert, Assess, Act," protocol for all types of emergencies and the "Run, Hide, Fight" response for an active shooter incident. Remain ALERT (through direct observation or emergency notification), ASSESS your specific situation, and ACT in the most appropriate way to assure your own safety (and the safety of others if you are able). Please sign up for emergency alerts on your account at MyWSU. For more information on this subject, campus safety, and related topics, please view the FBI's Run, Hide, Fight video and visit the WSU safety portal."

Attendance Policy: You must pick up and turn in all exams and assignments in person. Participation in paper discussions, ideation, and miniproposals must be done in person. It is expected that you will attend and critique the presentations of your colleagues. Lecture attendance is not required (but highly recommended). There are no make-up assignments (see late policy).

Lecture Schedule and Topics:

Lecture #	Date	Summary
1	1/9	Introduction 1: Learning Assessment (Starting Knowledge) What is a polymer? - PET and PS Retrosynthesis
2	1/11	Introduction 2: Polymer Nomenclature and Condensation Polymerizations
MLK	1/14	**MLK Day (No Class)**
PAPER	1/16	**Paper Discussion 1:** Hawker et al. JACS 2016, 138, 6306-6310
3	1/23	Polymerization Mechanisms 1: Step-Growth vs. Chain-Growth (PE and PLA Synthesis)
4	1/25	Polymer Characterization 1: Mz, PDI and the Mark-Houwink equation
5	1/30	Polymer Characterization 2: Ostwald Viscometery and Size Exclusion Chromatography
6	2/1	Polymerization Mechanisms 2: Ziegler-Natta Catalysis (LDPP Synthesis + Applications)
7	2/6	Polymer Characterization 3: Tacticity, Liquid Crystals, and DSC
8	2/8	Polymerization Mechanisms 3: Ring Opening – (Grubbs ROMP and Deming NCA)
9	2/13	Polymerization Mechanisms 4: Anionic, Cationic, and Radical (PS 3 Ways)
10	2/15	Polymer Characterization 4: Light Scattering - Mw by Rg and Zimm Plots
EXAM	2/15	**Exam 1: Distributed 2/15/2017 DUE 2/22/2017**
PRES	2/20	**President's Day (No Class)**
EXAM	2/22	**Exam 1: DUE in class at 11:10 am**
IDEA	2/22	**Ideation 1:** New Polymerization Methods
11	2/27	Controlled Polymerization 1: Engineering Controls (PS Emulsion)
12	3/1	Controlled Polymerization 2: Atom Transfer Radical Polymerization
13	3/6	Controlled Polymerization 3: Radical Addition Fragmentation Chain Transfer
14	3/8	Polymer Characterization 5: 1D NMR (in-class end-group analysis)
BREAK	3/13	**SPRING BREAK**
BREAK	3/15	**SPRING BREAK**
15	3/20	Polymer Characterization 6: 2D NMR (COSY and DOSY) - Bill Hiscox (tentative)
16	3/22	Polymeric Architectures 1: Cross-Linking and Macrocycles
17	3/27	Polymeric Architectures 2: Dendrimers and Hyperbranched Polymers
18	3/29	Polymeric Architectures 3: Stimuli-Responsive Polymers
PAPER	4/3	**Paper Discussion 2:** Tillman et al. *Macromolecules,* **2016**, *49*(20), 7804-7813
IDEA	4/5	**Ideation 2**: New polymer architectures
19	4/10	Current Applications 1: Protein-Polymer Conjugates
20	4/12	Current Applications 2: Rotaxanes and Catenanes
MINI	4/17	**PowerPoint Miniproposal 1**
MINI	4/19	**PowerPoint Miniproposal 2**
MINI	4/24	**PowerPoint Miniproposal 3**
MINI	4/26	**FINAL EXAM DISTRIBUTED (Due May 3, 2017)** **Miniproposal 4 and Course Survey**