Introduction to Polymer Chemistry

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Chem 388.60
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1516N

Catalog description. Mechanisms of polymerization reactions of monomers and molecular weight distributions of products; principles, limitations and advantages of most important methods of molecular weight determination; relationship of physical properties to structure and composition; correlations of applications with chemical constitution. Prerequisite: Organic Chemistry 2 (CHEM 224)

Objective: to learn polymer synthesis, characterization and utilization

The objective is met through lectures, readings from the literature posted on Blackboard that supplement the lectures, oral assignments, two exams and a final examination.

Learning Outcomes. Polymer materials are encountered on a daily basis since they are components of both common materials and advanced devices. The wide range of applications of polymers is derived from the immense variability in the compositions and structures that lead to highly diverse materials properties. Students will gain significant fundamental knowledge of polymer chemistry. They will be able to: (1) Describe polymer structural features, (2) describe various polymerization chemistries, (3) Provide polymer structures, given reagents and conditions, (4) Draw reaction mechanisms for the most important polymerization reactions, (5) Understand polymer modification chemistries, (6) Apply concepts of polymer chemistry to propose construction of complex polymeric materials, (7) Analyze physical, chemical and mechanical properties data, (8) Evaluate common products to recognize polymer components and identify their purpose(s), (9) Formulate structure-property relationships, i.e., relate the compositions and structures of polymers to expected physical, chemical and mechanical properties, and in the reverse, be able to transform purposes and performance criteria for polymer applications into chemical compositions and structures that could exhibit the appropriate properties, (10) Design polymer structures based upon desired properties and applications.

Oral assignment: Choose a topic from papers posted on Blackboard labeled Topic*xy_aaaaa*.pdf. Topic01 is a multi-chapter book and you can choose one of the chapters as your presentation; Topic02 – Topic17 are papers from the ACS *Journal of Chemical Education* and are targeted toward undergraduate chemistry majors. Choose whichever topic is of interest to you. If you find another paper that is more closely aligned with your interests or research, I'm happy to discuss it with you. Study the paper you choose, read the references within the paper for background information, and present it to your classmates: 2 students per presentation; 30 min per presentation; two presentations per given day. *Let me know your choice by October 3*

The dates of the oral assignments are on the syllabus. The date of your presentation depends on the topic; I will schedule it by October 5 and post the schedule on Blackboard. Everyone is to have come to class having read the paper before the presentation. Additional topics that may be of interest and for which you can search the literature are:

chiral polymers
dye-sensitized photopolymerization
group transfer polymerization

acyclic diene metathesis polymerization
ring opening metathesis polymerization
synthesis of biopolymers (polypeptides and polynucleotides)

Grade

Oral assignment	15% of final grade
Exam I	20% of final grade
Exam II	20% of final grade
Final Exam	35% of final grade
Class participation	10% of final grade

Lectures

1. Introduction, terminology and classification (see pdf)
2. Step – growth polymerization: polyesters and polyamides
3. Step – growth polymerization: phenolics, epoxies and polyurethanes (see pdf)
4. Kinetics of step-growth polymerization
5. Chain – growth polymerization: introduction
6. free-radical reactions (see pdf)
7. polymerization processes (see pdf)
8. ionic reactions (see pdf)
9. coordination polymerization (see pdf)
10. copolymer formation and reactivity ratios
11. Characterization: rheology, solubility, viscosity and molecular weight
12. Naturally-occurring and biodegradable polymers (see pdf)
13. Utilization: ion exchange resins (see pdf)
14. polymer-supported reagents and catalysts (see pdf)
15. Review (see pdf)

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http://www.cuny.edu/about/administration/offices/la/Policy-on-SexualMisconduct-12-1-14-with-links.pdf