

Chemistry 609
Organometallic Chemistry
Spring 2008

Instructor: Prof. Kevin Shaughnessy
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Class Meeting: MWF: 11:00 AM – 11:50 PM
Class Location: 251 Shelby Hall
Office Hours: by appointment

Class Webpage: <http://bama.ua.edu/~kshaughn/ch609/ch609.htm>

The web site will be used to post all class materials, make announcements, and provide access to online resources.

Text: Robert H. Crabtree, *The Organometallic Chemistry of the Transition Metals*, 4th Ed, John Wiley & Sons, 2001.

Objective: This course is an introduction to the structure, bonding, and reactivity of organotransition metal compounds. Aspects of this relatively young and incredibly vital subject that will be covered are indicated in the attached outline. This class will focus on physical organometallic chemistry, particularly the mechanisms of organometallic transformations and methods for their elucidation. In this course we will discuss some of the fundamental types of organometallic reactions: ligand substitution, oxidative addition/reductive elimination, migratory insertion, attack on coordinated ligands, and the reactivity of metalacycles, carbenes, and carbynes. This course will also focus on the important applications of organotransition metal complexes in catalysis and organic synthesis.

Grading: Your grade will be assigned based on your performance on the following assignments and exams:

Problem Sets	200 points (5 × 40 points)
Mid-Term Exams	200 points (2 × 100 points)
Literature Review Paper	100 points
<u>Final</u>	<u>150 points</u>
Total	600 points

Assignments:

Class Schedule and Reading Assignments: The schedule on the following pages provides the outline of the topics to be discussed in this class. Suggested reading assignments from the Crabtree book are provided in each section. Please note that this is a highly tentative schedule. Additional reading assignments from the primary literature will be assigned as necessary.

Problem Sets: Problem sets will be handed out in class approximately one week before their due date (see class schedule). Topics for the problem sets may include material not discussed in class. You are free to consult any literature source to assist you in answering the problem sets. You may not work on these problem sets in groups, however.

Literature Review Paper: The topic for your paper will be a review of either an industrial process or synthetic method catalyzed by transition metal complexes. Suggested topics will be posted on the class web site in the near future, but you are welcome to suggest your own topics. All topics must be approved by me prior to the date listed in the class schedule. Only one person may write about each topic. The first person to request a topic will have priority. A more detailed description of this assignment will be provided later in the semester.

Exams: Mid-Term exams will be given during the weeks shown in the schedule below. My preference will be for the exam to be given out of class at a mutually acceptable time to give you

sufficient time for completion. Information to be covered on each mid-term exam will be announced in class prior to each exam, but will generally involve all material covered up to the week prior to the exam. The final exam will be comprehensive. All exams will be closed book. Examples of exams from 2004 can be downloaded from the class web site.

Class Notes: Detailed outlines of the class notes will be available from the class web site prior to class meetings.

Academic Misconduct: All acts of dishonesty in any work (i.e. use of outside aids on exams, etc.) will constitute academic misconduct. The Academic Conduct Disciplinary Policy will be followed in the event of suspected academic misconduct.

Disability Accommodation: If you require disability accommodations, please contact Disability Services in the Center for Teaching and Learning (348-4285). Once initial arrangements have been made with that office, contact the instructor.

Tentative Class Schedule

Dates	Topic	Reading
<u>Week 1</u>		
1/9	Introduction--Structure and Bonding	Crabtree: Chapter 1 Notes: Chapter 1
1/11	Oxidation state and the 18 electron rule	Crabtree: Chapter 2 Notes: Chapters 2
<u>Week 2</u>		
1/14	Oxidation state and the 18 electron rule	
1/16	Survey of ligands	
1/18		Crabtree: Chapter 3 Notes: Chapters 3.1
<u>Week 3</u>		
1/21	No Class – MLK, Jr. Birthday	Crabtree: Chapters 3, 4.1-2, and 5
1/23	Survey of ligands	Notes: Chapters 3.1-3.2
1/25	Physical Methods in Organometallic Chemistry	Crabtree: Chapter 10 Notes: Chapter 4
<u>Week 4</u>		
1/28	Physical Methods in Organometallic Chemistry	
1/30	Ligand Substitution	Crabtree: Sections 4.3-4.7
2/1	Problem Set 1 Due	Notes: Chapter 5
<u>Week 5</u>		
2/4	Ligand Substitution	
2/6	Oxidative Addition I-Non-Polar Reagents	Crabtree: Chapter 6 Notes: Chapter 6.1
2/8		
<u>Week 6</u>		
2/11		
2/13	Oxidative Addition II-Polar Reagents	Crabtree: Chapter 6
2/15	Problem Set 2 Due Deadline to Choose Paper Topic	Notes: Chapter 6.2
<u>Week 7</u>		
2/18	Exam 1 – Time TBA	
2/20	Oxidative Addition II-Polar Reagents	Crabtree: Sections 9.6 and 14.4
2/22	Cross-Coupling Reactions	Notes: Chapter 7
<u>Week 8</u>		

2/25	Cross-Coupling Reactions	Crabtree: Section 12.4
2/27	C-H Activation and Functionalization	Notes: Chapter 8
2/29		
<u>Week 9</u>		Crabtree: Chapter 7
3/3	Migratory Insertion	Notes: Chapter 9
3/5		Crabtree: Section 12.1
3/7	Problem Set 3 Due	Notes: Chapter 10
	Carbonylation	
<u>Week 10</u>		Crabtree: Sections 9.2, 9.3, and 14.2
3/10	Hydrogenation	Notes: Chapters 11-12
3/12	Paper Draft Due	
3/14	Hydroformylation	
<u>Week 11</u>	Spring Break	
3/17		
3/19		
3/21		
<u>Week 12</u>		
3/24	Coordination Polymerization of Olefins	Crabtree: Section 12.2
3/26		Notes: Chapters 13.1-13.2
3/28		
<u>Week 13</u>	Coordination Polymerization of Olefins	Notes: Chapter 13.2
3/31	Peer Review Reports Due	
4/2		
4/4	Carbenes and Carbynes	Crabtree: Chapter 11
		Notes: Chapter 14
<u>Week 14</u>		
4/7	ACS Meeting, no class	
4/9	ACS Meeting, no class	
4/11	Carbenes and Carbynes	Crabtree: Chapter 11
	Problem Set 4 Due	Notes: Chapter 14
<u>Week 15</u>	Exam 2	Crabtree: Section 12.1, 14.6
4/14	Olefin Metathesis	Notes: Chapter 15
4/16		Crabtree: Chapter 8, 14.6
4/18	Ligand Centered Reactions	Notes: Chapter 16
<u>Week 16</u>		
4/21	Ligand Centered Reactions	
4/23		
4/25	Literature Review Paper Due	
<u>Week 17</u>	Organometallic Oxidation Catalysts	Crabtree: Section 14.2
4/28		Notes: Chapter 17
4/30		
5/2	Problem Set 5 Due	
<u>Finals Week</u>		
5/6	Final Exam (8:00 - 10:30 AM)	