Chemistry 423/523
Advanced Organometallic Chemistry

Dr. Dave Berg

Office: Elliott 314 — Monday 2:00-3:00 pm; Wednesday 3:00-4:00 pm or by appointment

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Useful texts:

'Organometallic Chemistry', Spessard and Miessler
'Organometallic Chemistry', Elschenbroich and Salzer
'Organometallic Chemistry', Powell
'Organometallic Chemistry', Crabtree

Grades: The total percentage mark will be made up as follows for Chem 423 and 523:

Chem 423:	Midterm 1	Friday, Oct 21	25 %
	Midterm 2	Friday, Nov 18	25 %
	Final		50 %
Chem 523	Midterm 1	Friday, Oct 21	25 %
	Midterm 2	Friday, Nov 18	25 %
	In-class special topics presentation		10%
	Term paper/proposal		40%

Examinations:

Midterms	50 minutes
Final	3 hours

Syllabus

The following outline is intended as a study guide only, to complement the material presented in the lectures. The lectures are your best guide to the level of detail required.

A Basic bonding concepts and M.O. theory.

- review of basic M.O. theory
- ligand bonding and metal-ligand interactions
- π-donors: alkoxides and amides
- π-acceptors: CO and ethylene
- alkynes and cyclic π-systems: both π-donors and acceptors
- allylic and cyclopentadienyl ligands

B Organometallic concepts, terminology and nomenclature.

- electron counting and the 18 e^- (EAN) rule
- neutral vs. charged counting schemes
- formal oxidation states
- relationship to M.O. theory
- exceptions to the 18 e^- rule: stable d^8 16 e^- complexes
- organometallic nomenclature

C General synthetic strategies.

- methathesis
- protonolysis (hydrogenolysis)
- reductive routes
- insertions

D NMR spectroscopy and fluxional processes.

- chemical shift norms
- heteronuclear NMR
- fluxional processes: coalescence temperature and energy barriers
- examples of fluxional processes: hapticity changes and rotational barriers

E Organometallic Reactions I: Reactions at the metal.

- ligand substitution
- oxidative-addition
- reductive-elimination

F Organometallic Reactions II: Reactions involving the ligands.

- insertion and deinsertion of unsaturated substrates
- nucleophilic addition
- electrophilic reactions

G Industrial homogeneous catalysis.

- basic principles
- hydroformylation
- hydrogenation/isomerization of alkenes
- Monsanto process
- Wacker process
- Ziegler-Natta polymerizations

H Alkylidenes (carbenes) and alkylidynes (carbynes).

- bonding and formation
- nucleophilic vs. electrophilic alkylidenes
- alkene metathesis

Note on problem sets: Problem sets will be assigned periodically and answer sets will be available on the course web site approximately one week later. Although these assignments are not graded, it is **strongly recommended** that students attempt each set.