Literature Review Paper Assignment*

Choice of topic: Below I have listed a number of transition-metal catalyzed reactions which are important for organic synthesis.This is not an exhaustive list, but is merely a suggestion. You may choose one of the topics below, or you may choose your own topic. You should pick a catalytic cycle where the metal is intimately involved in bond formation or breaking. Once you have settled on a topic, email me (tzschuck@chemi.fu-berlin.de) to reserve your choice and get my approval. If two people request the same topic, the first person to request the topic will have priority.

Writing the Paper: Your assignment in writing this paper is to provide a detailed review of a transition-metal catalyzed reaction, its development, its mechanism, and its current applications. Your paper should be sufficiently focused that you can give a detailed description in the allotted space. Some of the suggested topics below are fairly broad. In these cases it will be best to focus on a specific class of catalysts, substrates, or selectivity within the broad topic. I strongly recommend that you discuss the outline for your paper with me after you have reviewed the literature and before you start writing the paper.

Suggested organization of your paper:

• Describe the early reports of the catalytic reaction you are reviewing.

• Discuss in detail the mechanism of the catalytic cycle. Focus your discussion on how the mechanism has been investigated where possible. A graphic showing a detailed catalytic cycle, with ligands, specific substrates, etc., is a required element of your paper.

• If possible, describe efforts to apply the mechanism to designing improved catalytic systems.

• Discuss the current "state-of-the-art" system(s) and the types of problems to which they are being applied.

• Briefly discuss current limitations of the catalyst systems, or areas of future research.

Formatting Requirements

Title Page: The first page of your paper must be a title page with your name and the title of your paper. The text of your paper should start on page 2.

Text: Your paper should be no more than 15000 characters (including spaces, not including figures, schemes, references) long, that is approx. equivalent to 6 pages in a printed journal. Use Times 12 pt, doubles spaced, wide margins (top, bottom, left 2.5 cm, right 4,5 cm) to leave room for comments.

Avoid plagiarism. Be sure that the text is your own words, not repeating text you've read. While you may safely quote papers if necessary with appropriate citation, this is generally not recommended in technical papers. You should take what you've read and synthesize it into your own thoughts and words, while using citations to indicate the source of the prior work you discuss. Papers are subject to internet searches to look for similar text. Cases of plagiarism will result in failing the course and will be referred to the Prüfungsausschuss.

References: Your paper must provide references to the literature. While there is not "correct" number of references, a well researched paper should probably have 10-20 references. I strongly encourage using SciFinder in your literature searching. Any concepts/results that you discuss that would not be considered common knowledge (i.e. any chemist would know that)

* adapted from Kevin H. Shaughnessy, University of Alabama, http://bama.ua.edu/~kshaughn/ch609/ch609.htm

should include a reference to the primary literature (the original report of that result or idea, not a review article). References, should be formatted using JACS style, but with paper titles included (see recent issue or the JACS web site). Use superscript citations within text for references. References should be listed in an endnote bibliography in order of appearance. Your references should come predominately from the primary literature (i.e. journal articles and research texts). References to web materials should be used sparingly, if at all.

Graphics: Chemical structures should be drawn using ChemDraw using the J. Amer. Chem. Soc. drawing settings (these settings are available in ChemDraw or can be found in the first issue of JACS or its web site). Copied chemical structures/schemes from journal articles are unacceptable. Only graphics, such as spectra or charts, which could not be reproduced by you, may be copied from articles. In these cases, they must be correctly referenced and you should ensure the graphic is of good quality. ChemDraw is available to all FU students from the departments homepage (http://www.bcp.fu-berlin.de/service/it/ChemOffice.html).

Initial Draft Submission:

By June 8, you should email me a PDF copy of your paper. Treat this as if you are submitting a paper for publication. Your draft should have been carefully edited and be complete. Although you will have a chance to revise this draft, it should be as close to a final draft as possible. You will be graded on the quality of this draft. I will review your paper and hand it back to you with suggested improvements and comments by June 22.

Final Version:

Use my comments to revise your paper and email me the final version of your paper by July 6. Your grade will depend to a significant extend on how you improved your paper and how you addressed comments.

Important Dates:

• May 11, 2012: Deadline to choose your paper topic.

• June 8, 2012: Initial draft of your paper is due.

• July 6, 2012: Final version of your paper is due.

Grading:

Initial draft 40 points

Final version 60 points

Oral exam 100 points

Some suggested topics:

Olefin oligomerization and polymerization

- Metallocene Catalysts for Olefin Polymerization
- Constrained-Geometry Catalysts for Olefin Polymerization
- Stereoselective Polymerization of Higher Olefins with Metallocenes
- Late-Metal Catalysts for Olefin Polymerization
- Co-polymerization of olefins and CO
- Ring Opening Metathesis Polymerization (ROMP)
- Acyclic Diene Methathesis Polymerization (ADMET)
- Shell Higher Olefin Process (SHOP)
- Telomerization of Butadiene
- Cyclotrimerization of Alkynes
- Trimerization and/or tetramerization of ethylene
- Alkene Dimerization

C-H Functionalization

- Alkane dehydrogenation (alkane → alkene)
- Alkane Borylation (alkane → alkylborane)
- Alkane Carbonylation (alkane → aldehyde)
- Selective Alkane Oxidation (alkane → alcohol, etc)
- Murai Reaction
- Arene Oxidation (halogenation, hydroxylation, etc)
- Direct Arylation of Arenes or Heteroarenes
- Catellani Reaction

Carbonylation

- Carbonylation of Alcohols (Acetic Acid Process)
- Alkene Hydroformylation
- Alkene Hydrocarboxylation
- Pauson-Khand Reaction

Additions to Alkenes and Related Reactions

- Hydrocyanation
- Alkene hydrogenation
- Asymmetric Hydrogenation of alkenes
- Atom-Transfer Hydrogenation
- Arene Hydrogenation
- Alkene Hydrosilylation
- Ketone Hydrosilylation
- Metal Catalyzed Hydroboration
- Decarbonylation of Aldehydes
- Reduction of CO to methanol
- Transfer Hydrogenation

Oxidation

- Sharpless Epoxidation of Allylic Alcohols
- Asymmetric Epoxidation
- Asymmetric Dihydroxylation
- Palladium-catalyzed aerobic oxidation of alcohols.
- Aminohydroxylation
- Wacker Oxidation
- Amine Addition to Alkenes

Coupling Reactions

- Heck Reaction
- Suzuki Coupling
- Stille Coupling
- Sonagashira Coupling
- Negishi Coupling
- Hiyama Coupling
- Hartwig-Buchwald Amination
- Arylation of Enolates
- Copper-Catalyzed Cross-Couplings (Ullmann Coupling)
- Nickel-Catalyzed Cross-Coupling
- Iron-Catalyzed Cross-Coupling

Miscellaneous

- Asymmetric Allylic Substitution
- Rhodium-Catalyzed Carbene Insertions
- Rhodium-Catalyzed Conjugate Additions
- Ring-Closing Metathesis
- Diene Cyclization
- Enyne cyclization
- Alkene Carbometalation