

Homogeneous Catalysis, 5hp – PhD level course

Time: second half of autumn semester, parallel to Master course “Coordination and Organometallic Chemistry” 1KB464

Learning Outcomes

After completion of the full course the student should be able to:

- Discuss the advantages and disadvantages of homogeneous catalysis and its importance in synthesis.
- Discuss the basis of how catalysis works.
- Describe metal-ligand interactions and bonding for different ligands.
- Propose viable mechanistic routes for catalytic reactions not previously encountered.

Content

The course will discuss the properties of various ligands and metal-ligand interactions in organometallic complexes (e.g. σ -donation and π -backbonding, denticity, hapticity, coordination numbers and metal oxidation state changes). Building on this, the discussion will shift to how catalysis works, including concepts such as TONs, TOFs, resting states, the fundamental reactions that make up organometallic catalysis (e.g. oxidative addition, reductive elimination, β -hydrogen elimination) and how these combine to create productive cycles. These concepts will then be used in discussing the importance and workings of homogeneous catalysis in its various forms, including economically important reactions, such as the Wacker oxidation, metathesis and cross-coupling chemistry.

Instruction

Lectures and problem solving sessions.

Assessment

Two parts:

- 1) Each student will make a Powerpoint presentation based around a concept encountered in modern catalysis (e.g. the mechanistic aspects of a fundamental reaction or a summary of recently published literature topics).
- 2) Exam.

You need to pass both parts to get credits for the course.

Reading List

The recommended textbooks for this course are either *Organotransition Metal Chemistry* by John Hartwig or Spessard & Miessler *Organometallic Chemistry*, 2nd ed.