Oxidation Catalysis Enabled by Donor-Flexible Ligands

Martin Albrecht
Department of Chemistry, Biochemistry & Pharmaceutical Sciences
University of Bern, Switzerland

While catalytic reductions (hydrogenation, hydroelement functionalizations) are very well understood mechanistically and many high activity catalysts are available nowadays, oxidation catalysis is much less developed. This is due in parts to the mechanistic complexity of oxidation reactions (substrate recognition, multistep multi-electron transformations), and in other parts due to the harsh conditions for oxidation reactions, requiring catalysts with a specific set of properties that impart high activity and high robustness. In the search of suitable ligands that meet these criteria, we have become particularly intrigued by ligands that can formally adopt either a neutral or a zwitterionic form. Through their different bonding modes, these ligands provide opportunities to (transiently) store protons and electrons, which is an excellent prerequisite for mediating oxidation reactions. The presentation will demonstrate the potential of these donor-flexible ligands to induce challenging bond activation catalysis for synthetic and energy-related applications such as water oxidation, CO₂ reduction, and recently also CH bond amination.