

Sustainable electrochemical Oxidation Processes using Water as Oxygen-Source

The So-WAT project aims to develop sustainable electrochemical oxidation processes that utilize water as the oxygen source under mild conditions, using 3d-metal-based complexes as catalysts. This innovative approach addresses critical challenges in oxidation catalysis, which typically depends on unsustainable processes involving noble metals or stoichiometric oxidants. Inspired by metalloenzymes, the project focuses on generating high-valent metal-oxo species through electrocatalysis, facilitating oxidation reactions with minimal environmental impact.

The research involves three key objectives: (1) electrogeneration of high-valent 3d-metal oxo species from water, (2) development and performance evaluation of electrocatalytic oxidation processes, and (3) optimization of catalytic systems through mechanistic studies and rational design. By combining analytical and spectroscopic techniques with catalyst design, the project aims to enhance catalyst stability, selectivity, and efficiency in a long-term strategy while addressing sustainability concerns.

The feasibility of the project is supported by extensive literature data and strong expertise in the field. High-valent metal-oxo species have been well-characterized, and preliminary studies demonstrate their potential for oxidation reactions. The target metal complexes are either commercially available or accessible through established collaborations, or their synthesis is described. Additionally, the team has significant experience in homogeneous electrocatalysis and mechanistic studies, ensuring a solid foundation for success.

A PhD student will be recruited and trained in inorganic chemistry, electrochemistry, catalysis, and spectroscopy. Their work will focus on synthesizing metal complexes, studying their redox properties, evaluating catalytic performance, and identifying key intermediates.

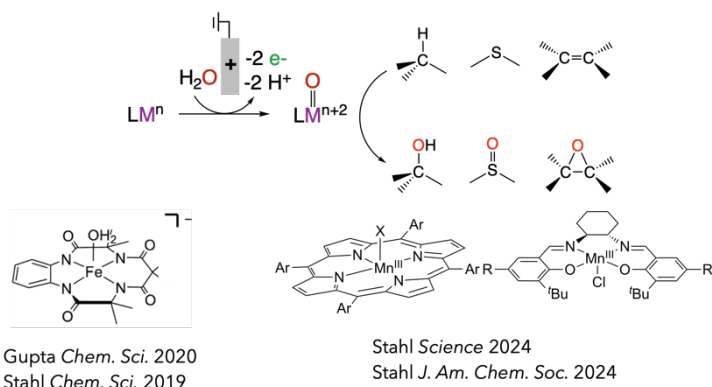


Figure 1. (top) Illustration of the strategy to develop electrocatalytic oxidation processes using water as the O-atom source. (bottom) previously described catalysts