Modelling bioinspired catalytic materials: A gas phase cluster approach

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Enzymes are of fundamental importance for all living organisms since they catalyze numerous pivotal biological processes. The mild reaction conditions of the catalytic processes and the utilization of earth-abundant elements in the catalytically active centers renders such biocatalysts prototype systems for "green", i.e., environmentally friendly, sustainable, and energy efficient catalysts. In our research projects, we aim to artificially prepare bioinspired catalytic materials and to learn from nature for the future tailor-made design of new active, selective, energy and cost efficient catalysts for industrial applications. Toward this goal we model the catalytically active centers of metalloenzymes in the form of gas phase cluster ions and investigate their intrinsic chemical properties in an isolated environment via reaction studies under temperature controlled gas phase conditions in an ion trap and infrared spectroscopy. This gas phase approach provides the unique possibility to study well defined model systems on a strictly molecular level and to precisely control the model-system's complexity. In this talk I will address two different model systems, iron-sulfide cluster as model system for iron-sulfur enzymes as well as (calcium)-manganese oxide clusters as model system for photosystem II.