unicat
Unifying Concepts in Catalysis

7th Annual General Meeting

Wednesday, November 27th, 2013 at 4:30 pm

at

TU Berlin, Department of Chemistry, Straße des 17. Juni 115, 10623 Berlin

C Building, Lecture Hall C 264

Prof. Matthias Driess (Chair),
Prof. Peter Hildebrandt (Vice Chair):
Welcome and Status Report

Dr. Patrick Scheerer, Protein X-ray Crystallography, Institute of Medical Physics and Biophysics, Charité Berlin:
Structural insights into the oxygen-tolerant [NiFe] hydrogenase of Ralstonia eutropha H16

Hydrogen is a major clean energy carrier and therefore considered as promising source in renewable energy technologies. Hydrogenases catalyze the reversible oxidation of molecular hydrogen (H_2) into protons and electrons at high rates. However, most of these metalloenzymes are readily inactivated by O_2. One subgroup of the typical [NiFe] hydrogenases has evolved remarkable tolerance towards O_2. We investigate the chemical and structural properties of O_2-tolerance of the well-characterized membrane-bound [NiFe] hydrogenase (MBH) from the aerobic H_2 oxidizer *Ralstonia eutropha* H16. The heterodimeric MBH consists of a large subunit harbouring the catalytic [NiFe] centre and a small subunit containing an electron relay consisting of three different iron-sulphur clusters. The MBH is attached to the periplasmic side of the cytoplasmic membrane and feeds the electrons derived from H_2 oxidation via a membrane-integral b-type cytochrome directly into the respiratory chain. One crucial feature for O_2-tolerance bases on a unique six cysteine-coordinated [4Fe3S] cluster located close to the catalytic [NiFe] center of the enzyme. This unprecedented [4Fe3S] cluster undergoes redox-dependent reversible structural rearrangements, firstly an iron swapping between a cluster-sulfide and a peptide backbone amide N and secondly a so far unexpected oxygen ligand located at a different iron. Moreover, this oxygen ligand is hydrogen-bonded to a conserved histidine residue that is essential for H_2 oxidation at high O_2. All three redox-states of the [4Fe3S] cluster as well as the cluster architecture regarding to the O_2-tolerance of the membrane-bound [NiFe] hydrogenase have been analyzed by X-ray crystallography.

Dr. Anna Fischer, Nanostructured Electrodes for (Bio)-Electrocatalysis, Institute of Chemistry, TUB:
Nanostructured interfaces for the immobilization of electrocatalysts
From enzymes to nanoparticles

Nanostructured conductive materials with high surface area are increasingly important for the development of supported electrocatalytic systems be it for the immobilization of redox active enzymes or size selected nanoparticles. Especially for the immobilization of high loadings of catalysts, conductive materials with defined porosity in terms of pore sizes and pore connectivity are eagerly required. Particularly interesting in this context are nanostructured transparent conductive materials. Besides providing the required conductivity and surface area to the system for optimized performance, they also allow due to their transparency to gain fundamental insights into the immobilization processes, involving the catalyst-material interface.

Prof. Dr. Matthias Driess (TUB), Chair - Cluster of Excellence UniCat
Prof. Dr. Peter Hildebrandt (TUB), Vice Chair – Cluster of Excellence UniCat