

Nanostructured Solid Catalysts for Sustainable Chemical Production and Energy Conversion

Prof. Dr. Malte Behrens

Solid-State Chemistry & Catalysis, Institute of Inorganic Chemistry

Kiel Nano, Surface and Interface Science (KiNSIS)

Kiel University, Germany

mbehrens@ac.uni-kiel.de

<https://www.ac.uni-kiel.de/de/behrens>

Chemical energy storage and conversion is a cornerstone of the transition towards the CO₂ emission-free utilization of renewable energy. Many of such processes are catalytic in nature and the development and optimization of new catalysts is a major handle for increasing the efficiency of our energy systems. Prominent examples are water electrolysis to so-called green hydrogen, its use in CO₂ hydrogenation reactions to value-added products or synthetic fuels, or its storage and distribution in form of ammonia.

Ideally, the catalysts for such reactions are made from abundant elements and easy to synthesize. In my lecture, I will introduce the versatile and scalable method of aqueous coprecipitation for catalyst synthesis and show several examples of the resulting nanostructured catalytic materials. These cannot only yield highly performant catalysts, but also form a basis for composition- and structure-activity correlations that help to better understand the fundamentals of the complex interfacial chemistry of catalyst conversions on solid surfaces.

Examples from our recent work cover the methanation of CO₂^[1,2] and ammonia decomposition on Ni and bi-metallic FeCo alloy catalysts for ammonia decomposition,^[3] as well as the Al-promotion of Cu/ZnO-based catalyst for methanol synthesis.^[4-7]

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