Diplomawork within the Competence centre for Catalysis

Microemusion-tailoring of metal nanoparticles for catalysis

Motivation

Today catalysis plays a decisive role in the improvement of urban air quality as well as in energy conversion processes and will continue to do so. For example, automotive exhaust aftertreatment based on catalytic processes is considered necessary to meet future emission standards. Specifically, the development towards more energy efficient power trains includes highly advanced combustion engines and electrical hybrids that inevitable lead exhausts temperatures well below 200°C for significant periods of the drive cycles. Thus catalysts active at low temperatures are required. In order to develop new innovative catalytic systems possibility to tailor e.g. the active metal particles in the catalyst is important. This work focuses on how to prepare small/uniform metal particles for use in catalysis.

The project

The catalytic cycle is often described by a sequence of elementary processes including adsorption, (surface diffusion), reaction and desorption occurring on the catalyst surface. These processes significantly depend on the properties of the catalyst for example type of metal, metal oxide support material and also the preparation method and the size and shape of the particles. In this work the microemulsion route will be utilized to prepare small/uniform metal particles (e.g. Pt, Pd, Ag) and bi-metal particles as an option. The particles will be characterized using TEM (transmission electron microscopy). Furthermore (if time), the as prepared particles will be supported on a metal oxide support (e.g. Al_2O_3, CeO_2) and evaluated as catalyst for e.g. CO oxidation in a flow reactor system.

The project is for 6 or 12 months (starting autumn 2017) and includes

- Literature overview of the microemulsion preparation route
- Wet-chemical (microemulsion route) synthesis of various metal (and bi-metal) particles
- Characterization of particles using TEM
- Preparation of supported catalysts using the particles (optional)
- Evaluation of the supported catalysts for a model reaction, e.g. CO oxidation (optional)
- Oral and written presentation of the project

Do not hesitate to contact us if you are interested or have questions!

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