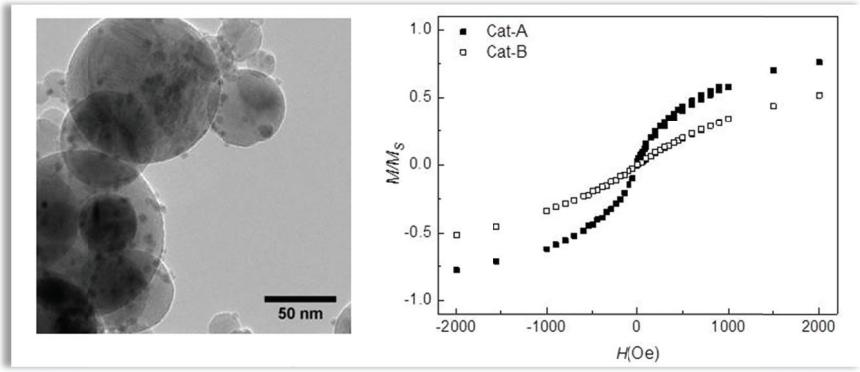
Nanoparticles – fundamentals and applications

In this project focus is put on the development of well-defined nanoparticles with controlled particle size and narrow size distribution (monodispersed particles), morphology, structural arrangement and element distribution. The synthesized particles are utilized for applied purposes within NOx abatement catalysis, cancer therapy and eco-toxicological studies. In addition we perform fundamental investigations related to electronic properties, detailed structural analysis of atomic arrangement and in-situ experiments to understand particle nucleation- and growth mechanisms.

Depending on the profile of the project various experimental techniques become relevant. Inert handling and Schlenk-line glass ware, high speed centrifuges, dynamic light scattering (DLS), powder X-ray diffraction (XRD), high resolution scanning electron microscopy (cold FE-SEM), physical property measurements (PPMS), synchrotron X-ray diffraction (SR-XRD) and total scattering analysis, density functional theory (DFT), small angle X-ray diffraction (SAXS), catalytic and biological testing in collaboration with external partners.



Left: TEM image of Ni/Al_2O_3 metal-on-support model catalyst for methanation reaction. Ni particle size: ~ 5.1 ± 1.0 nm.
Right: Magnetization data collected with PPMS. Information on Ni particle size and amount of metallic nickel on the catalyst.

Examples of this:

- What synthesis conditions are of importance in order to produce well-defined nanoparticles?
- How can you influence electronic properties by nano-engineering?
- How does the atomic arrangement relax when nanoparticle size decrease, and what is the element distribution?
- How effective are the nanoparticles for NOx abatement catalysis?
- In what way do the nanoparticles act relative to cancer therapy or eco-toxicity?
- How do nanoparticles nucleate and what is the growth mechanism?

What you will learn:

- How to use state of the art equipment for synthesis and characterization of nanoparticles
- In-situ investigations
- Design and build special equipment for optimization of your experiments
- How to use modern software for analyzing various data
- Become a key part of the Nafuma team and work closely with the researchers

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