TECHNISCHE UNIVERSITÄT WIEN
Vienna University of Technology

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IAP-SEMINAR

EINLADUNG

Termin: **Dienstag, 26.8.2014 um 16:00 Uhr**

Ort: **Technische Universität Wien,**
Institut für Angewandte Physik,
Seminarraum 134A, Turm B (gelbe Leitfarbe), 5. OG
1040 Wien, Wiedner Hauptstraße 8-10

Vortragende: **Petra de Jongh**
Inorganic Chemistry and Catalysis, Debye Institute for Nanomaterials Science, Utrecht University/The Netherlands

Thema: **The stability of supported Cu nanoparticles studied using 3D model methanol synthesis catalysts**

Kurzfassung

Catalysts typically consist of metal nanoparticles (<10 nm) as an active phase, supported on a porous material that provides stability to the system, but has 3D open porosity to allow diffusion of reactants and products. Metal nanoparticles have an inherent tendency to grow into larger crystallites, especially at increased temperatures and in reactive gas atmospheres, leading to a decrease in the specific metal surface area and hence activity. Recent advances using for instance in *in situ* electron microscopy, STM under low gas pressures and computational approaches yield information on the mechanisms and fundamentals of particle growth in model systems. However, relatively little is still known about the mechanisms of particle growth under real reaction conditions in 3D supported systems.

We study the growth of supported nanoparticles using 3D ordered mesoporous supports as a key tool. They allow mimicking realistic catalyst systems and conditions (100-400 ^{o}C, 1-50 bar pressure, H_2, CO, CO_2, alkenes, H_2O, O_2 feeds), while their highly defined morphology facilitates high precision in the variation of individual structural parameters. In this presentation I will highlight specifically the example of supported Cu nanoparticles, tracking the growth of the nanoparticles while being used as a methanol synthesis catalyst. We varied particle parameters such as size, size distribution, and average particle density, but also collective properties such as the nanospatial distribution of the metal nanoparticles over the support, and support pore size, window size, connectivity (for instance 1D or 3D porosity), and surface. As another important tool we use electron tomography, which is able to yield size, shape, and pore specific 3D location of all individual nanoparticles. This allows us, by probing at different moments in catalytic runtime, to study in great detail the interplay of different structural parameters, and obtain information on the nature of the mechanism of particle growth (for instance Ostwald ripening versus particle migration and sintering) under given conditions. the particle growth as a result of catalytic action in different 3D systems.

Alle interessierten Kolleginnen und Kollegen sind zu diesem Seminar
(45 min mit anschließender gemeinsamer Diskussion) herzlich eingeladen.

U. Diebold e.h.
(Seminar-Chairperson)

H. Störi e.h.
(LVA-Leiter)