Pt-CeO_2 Nanosponges - Synthesis and Catalytic Properties

S. Falkner[1], C. B. Maliakkal[2], M. Liebertseder[1], J. Czechowsky[3], M. Casapu[3], J.-D. Grunwaldt[3], C. Kübel[2]*, C. Feldmann[1]*

[1]Institute of Inorganic Chemistry, Karlsruhe Institute of Technology, Karlsruhe, Germany
[2]Institute of Nanotechnology, Karlsruhe Institute of Technology, Karlsruhe, Germany
[3]Institute for Chemical Technology and Polymer Chemistry, Karlsruhe Institute of Technology, Karlsruhe, Germany

E-Mail presenting author: Simon.Falkner@kit.edu

Highly porous Pt-CeO_2 nanosponges (1 wt-% Pt) are realized by thermal decomposition of a cerium-oxalate precursor at low temperature [1]. The non-porous cerium oxalate precursor is precipitated from an ethanol-water mixture and then decomposed to mesoporous CeO_2 nanosponges at 350 °C in air. The CeO_2 nanosponges exhibit a specific surface area of 113 m^2/g and a pore volume of 0.08 cm^3/g, mainly with mesopores (≥ 25 Å and ≤ 45 Å). These nanosponges are impregnated with Pt nanoparticles using $Pt(ac)_2$ in methanol and subsequent reduction by H_2, resulting in a uniform size distribution with Pt nanoparticles 1.8±0.4 nm in size. The catalytic properties of the CeO_2-Pt nanosponges are evaluated for CO oxidation (50-250 °C), formaldehyde oxidation (25-250 °C) and NH_3 oxidation (50-400 °C). A promising catalytic activity and mostly stable light-off/light-out temperatures are observed, indicating the suitability of CeO_2-Pt nanosponges as high-porosity catalyst material for several types of oxidation reactions.

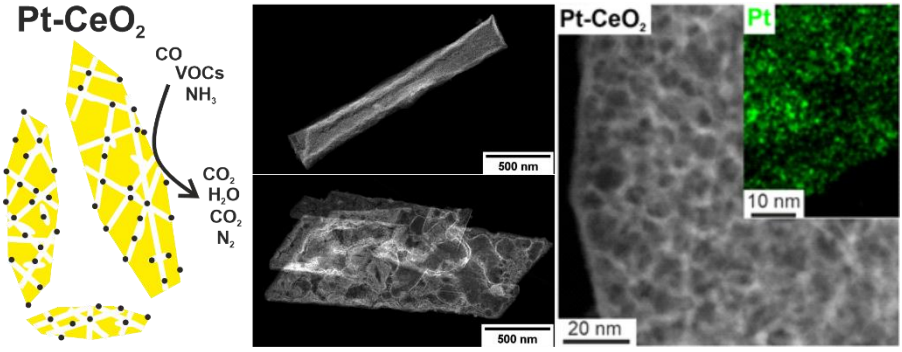

Figure 1: Scheme of Pt-CeO_2 nanosponges; overview STEM images of Pt-CeO_2 nanosponges; detailed STEM image, and EDXS Pt element mapping.

[1] S. Falkner *et al., Nanoscale Adv* **2024**, *submitted*.