Contribution submission to the conference Berlin 2024

The relation between substrate, Sm alloy, and surface sensitivity of cerium (111)- and (100)-oriented nano-islands on Ru(0001) and Cu(111). — •Raquel Sanchez-Barquilla, Rudi Tschammer, Lars Buss, Carlos Morales, and Jan Ingo Flege — Applied Physics and Semiconductor Spectroscopy, Brandenburg University of Technology Cottbus-Senftenberg, Germany

Inverse oxide/metal catalysis allows achieving better catalytic performance than its traditional counterpart. For example, in cerium-based inverse catalyst systems, the Ce^{3+} states have been shown to be the active sites for methanol synthesis. This suggests that the activity can be enhanced by promoting those through alloying with trivalent, catalytically active rare-earth metals, as, e.g. Sm. We present low-energy and X-ray photoemission electron microscopy (LEEM/XPEEM), investigations that show how epitaxially grown (100)- and (111)-oriented CeO_2 islands may be modified and/or alloyed by post-deposited metallic Sm. For the $Ce_{1-x}Sm_xO_{2-\delta}$/Ru(0001) system, the CeO_2 (111)-oriented islands undergo a structural change, concomitant with a partial conversion from Ce^{4+} to Ce^{3+}. Surprisingly, for $Ce_{1-x}Sm_xO_{2-\delta}$/Cu(111) the result is found to be face-dependent since only (100)-oriented CeO_x islands were reduced whereas the (111)-oriented islands remained unaltered. Both systems have been exposed to reducing (H_2) and oxidizing (CO_2) conditions, resulting in higher reduction and in a complete recovery of the Ce^{4+} states, respectively. These unexpected results indicate a complex interaction not only between cerium and the doping element, but also an intricate interplay with the metallic substrate.

Part: O
Type: Vortrag;Talk
Topic: Heterogeneous catalysis
Keywords: Ceria; Samaria; LEEM; Structure sensitivity
Email: sanchez@b-tu.de