Deutsches Elektronen-Synchrotron DESY
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Report on the habilitation thesis of

Dr. Viktor Johánek, entitled

"Reactions at surfaces: from macroscopic to molecular level"

The habilitation thesis of Dr. Johanek deals with the investigation of model catalysts by state-of-the-art surface science methods, which can deliver important insight into microscopic processes occurring during catalytic reactions. The reactions addressed by Dr. Johanek in his habilitation thesis include CO oxidation, NO_x reduction, the interaction of water with oxide surfaces as well as methanol and isopropanol oxidation. In addition, he has investigated the interaction of small organic molecules with model catalysts, which is relevant for hydrocarbon conversion reactions. The topics of his studies are very timely because of ongoing discussions how to improve air purification as well as catalytic reactions for energy storage and conversion.
Dr. Johánek has employed an impressive number of sophisticated surface characterization tools, such as a molecular beam coupled with mass spectrometry and Fourier transform infrared reflection absorption spectroscopy. Further on, he is using x-ray photoemission (synchrotron and laboratory based) and scanning tunneling microscopy together with thermal desorption spectroscopy.
The quality and quantity of his publications demonstrate, that his habilitation thesis is of high quality and the results obtained are very impressive. The results of the plagiarism test show some overlap with recent publications from Dr. Johánek, which is not surprising, given the cumulative nature of the habilitation thesis. They are thus uncritical.

From his first author publications the work entitled “Fluctuations and Bistabilities on Catalyst Nanoparticles” published in Science 304, 1639 (2004) is the most impressive example, which has been cited 185 times up to date. In this work he demonstrated, how during CO oxidation bistabilities in the reaction kinetics can occur, during which the system switches between a CO poisoned surface with low catalytic activity and an oxygen rich surface with high catalytic activity. He found that this bistability depends strongly on the reaction temperature but also on the dimensions of the system, elucidating especially the role of defects. This groundbreaking study gave detailed insight into the dynamics of a heterogeneous catalyst, triggering a large number of follow up studies.
In conclusion, I am convinced that the obtained results and publications presented in his habilitation thesis are a sound basis for Dr. Johánek’s future scientific career.

Prof. Dr. Andreas Stierle