11th/12th February 2019
Technische Universität Wien
Vienna, AUSTRIA

International Workshop on

Current Trends in SOFC Research

Bridging the Gap Between Fundamentals and Application

PROGRAM

New Perovskite Materials for Chemical Energy Conversion – Structural and Catalytic Characterisation

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In heterogeneous catalysis surfaces decorated with uniformly dispersed, catalytically highly active (nano)particles are a key requirement for excellent performance. Beside the standard catalyst preparation routines, e.g. impregnation or precipitation, with limitations in terms of controlling exactly the desired catalyst structure (i.e. particle size distribution or dispersion of nanoparticles), we present here a novel time efficient route to exactly tailor the catalyst surface.
An emerging concept in catalyst design, and the scope of our ERC project, is to selectively and reversibly tune and modify the surface chemistry/structure by electrochemical polarisation directly under reaction conditions. Perovskite-type catalysts raise the opportunity to incorporate guest elements as dopants. Upon electrochemical polarisation (applying voltage to the system) these dopants emerge from the oxide lattice to form catalytically active clusters or nanoparticles on the surface (by exsolution). In consequence this leads to a strong modification or enhancement of catalytic selectivity and activity. Furthermore electrochemical polarisation offers the possibility to adjust the surface chemistry in response to an external signal in real time.
Starting with the synthesis of new doped perovskite materials and the basic characterisation, we will present studies on catalytic reactions highly relevant for renewable energy technology and chemical energy conversion. Results for WGS and rWGS will be presented highlighting the influence of metal nanoparticle exsolution.

Acknowledgement:
This project has received funding from the European Research Council (ERC) under the European Union's Horizon 2020 research and innovation programme (grant agreement n° 755744 / ERC - Starting Grant TUCAS).