Extra Session of Focus Materialchemie – Tuesday, **19.10.2023** 14:00 – @ Seminarraum Lehar 01 (TU-Wien, Getreidemarkt 9, BC, OG. 02, room A46) – join us on ZOOM (ID: 983 0066 2349)

Fundamental Aspects of Catalysis Enlightened by In-Situ Studies in the Environmental Transmission Electron Microscope

Michael S. Seifner

DTU Nanolab, Technical University of Denmark, Ørsteds Plads 347, 2800 Kgs. Lyngby, Denmark

Centre for Analysis and Synthesis, Lund University, Box 124, 22100 Lund, Sweden

In the life cycle of a catalyst, several fundamental process steps that proceed at the nanoscale are involved and critical for promoting catalytic reactions.[1] Until lately, the understanding of catalysts, including synthesis-structure-property relationships, was primarily extracted from bulk measurements. Recent developments in in-situ electron microscopy have paved the way for studying catalysts under realistic conditions at an atomic level.[2]

This talk aims to highlight the potential of electron microscopy to explore fundamental catalysis steps enabling progress in designing efficient catalysts. Recent results generated in transmission electron microscopes supporting the supply of metal-organic precursors and reactants will be discussed. In particular, the talk will focus on approaches for designing surface/interface facets, engineering the crystal structure, and controlling the morphology of nanomaterials (see Figure 1). Moreover, recent developments will be introduced, including integrating light into electron microscopes to study lightmatter interactions.

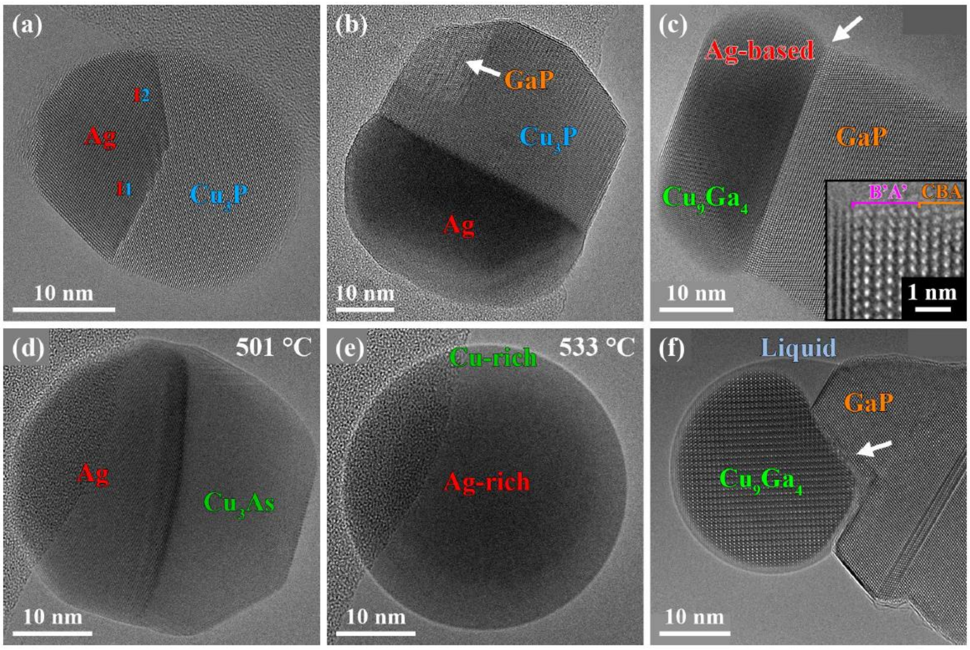

Figure 1. (a) Interface design in Ag-Cu_3P nanoparticles. (b) Investigation of diffusion mechanisms involved in synthesizing Ag-Cu_3P-GaP heterostructures. (c) Crystal structure engineering in GaP nanocrystals. (d-e) Reversible morphology changes in Ag-Cu_3As nanoparticles. (f) Growth direction manipulation in GaP nanocrystals.

The advancing development of electron microscopes in spatial resolution, imaging/spectroscopy techniques, and setups enabling experiments under environmental conditions can help create deep insights into fundamental aspects of catalysts. Progress in this field will require the interplay between different research fields to tackle the involved challenges, design meaningful experiments, and understand the generated data.

[1] S. Zhu, et al. Adv. Energy Mater. **2017**, 7, 1700841.
[2] S. Hwang, et al. Adv. Energy Mater. **2020**, 10, 1902105.