

Session of Focus Materialchemie – **Monday, 20.11.2023** 16:00 – @ Seminarraum Lehar 02 (TU-Wien, Getreidemarkt 9, BC, OG. 02, room A46) – [join us](#) on ZOOM (ID: 983 0066 2349)

Mixed Metal Nanoparticles

Created in Superfluid Helium Droplets

Wolfgang E. Ernst

Institute of Experimental Physics, Graz University of Technology, 8010 Graz, Austria

Through aggregation inside superfluid helium droplets, metal nanoparticles and core-shell clusters of different morphology are generated and deposited on solid carbon, h-BN, ITO, or SiN substrates. The created nanoparticles are characterized by temperature dependent electron microscopy, up to 1000 degrees C, energy-dispersive X-ray spectroscopy, electron energy loss spectroscopy, photoemission electron microscopy and optical absorption¹. Our investigations include the stability of a passivation of Ni, Fe, and Co cores of 2 to 3 nm diameter by a few layers of gold and the alloy formation at high temperature². Ag@ZnO core@shell particles are studied by two-photon photoelectron spectroscopy. Upon excitation of the localized surface plasmon resonance in Ag at around 3 eV, plasmonic enhancement leads to a strong increase in electron emission when compared to pure ZnO clusters³. Vanadium oxides represent a prominent materials class for catalytic applications. When deposited after clustering in helium, we have shown that V₂O₅ nanoparticles keep the original stoichiometry⁴. In combination with gold doping, Janus particles of Au and V₂O₅ with radii of about 20 nm were identified⁵.

References

1. W. E. Ernst and A. W. Hauser, PCCP **23**, 7553-7574 (2021), <https://doi.org/10.1039/D0CP04349D>.
2. M. Schnedlitz, D. Knez, M. Lasserus, F. Hofer, R. Fernández-Perea, A. W. Hauser, M. Pilar de Lara-Castells, and W. E. Ernst, J. Phys. Chem. C **124**, 30, 16680–16688 (2020), <https://doi.org/10.1021/acs.jpcc.0c04561>.
3. A. Schiffmann, T. Jauk, D. Knez, H. Fitzek, F. Hofer, F. Lackner, and W. E. Ernst, Nano Research **13**, 2979–2986 (2020), <https://doi.org/10.1007/s12274-020-2961-z>.
4. M. Lasserus, M. Schnedlitz, R. Messner, F. Lackner, W. E. Ernst, and A. W. Hauser, Chemical Science **10**, 3473-3480 (2019), <http://dx.doi.org/10.1039/C8SC05699D>.
5. W. E. Ernst, M. Lasserus, D. Knez, F. Hofer, and A. W. Hauser, Faraday Discussions **242**, 160 - 173 (2023), <https://doi.org/10.1039/D2FD00089J>.