MS031.O04

Crystallographic investigation of metallic and bimetallic nanoparticles

Oleg Prymak[1], Kateryna Loza[1], Viktoria Grasmik[1], Kevin Pappert[1], Alexander Rostek[1], Jens Helmlinger[1], Martin Gocyla[2], Marc Heggen[2], Matthias Epple[1]

[1]*Inorganic Chemistry, University Of Duisburg-Essen, Essen, Germany,* [2]*Ernst Ruska-Centre and Peter Grünberg Institute / Forschungszentrum Jülich GmbH, Jülich, Germany*

E-mail: oleg.prymak@uni-due.de

Metallic nanoparticles represent a well-established part of nanoscience today due to their tunable physico-chemical properties and their potential in nanomedicine. Especially noble metals and their combination in nanoalloys, including core-shell structures, have attracted high interest, with silver, gold, platinum, and palladium nanoparticles as most prominent examples. Due to the antibacterial effects (Ag), the easy covalent functionalization by thiol or phosphane chemistry (Au) and inherent catalytic properties (Pt, Pd), their applications are manifold. We have synthesized PVP-coated monometallic (Ag, Au, Pt, Pd) and bimetallic AgAu and AgPt nanoparticles by wet chemical co-reduction, including bimetallic core-shell nanostructures. Spherical and shaped (Ag, platelets, cubes, and rods) nanoparticles in a size range of 5-50 nm were produced and characterized by colloid-chemical (DCS), microscopic (SEM, HRTEM) and spectroscopic (EDX, UV-vis) methods. By extended crystallographic investigation using X-ray powder diffraction (XRD) with different geometrical setups including grazing incidence diffraction and pole figure analysis with subsequent Rietveld refinement, a precise determination of the lattice parameters, the crystallite size and the microstrain as well their preferred orientation as a function of morphology was performed. X-ray powder diffraction is well suited to describe not only the crystallographic identity of nanopatricles, but also their size and anisotropic morphology with further information about their domain nature: single or polycrystalline.

[1] Helmlinger, J. et al. (2016). Cryst. Growth Des. 16, 3677-3687.
[2] Ristig, S. et al. (2015). J. Mater. Chem. B3, 4654-4662.
[3] Banerjee, S. et al. (2014). Chem. Mater. 26, 951-957.

Keywords: noble metals, nanoalloys, core-shell