From novel heterometallic precursors to lithium doped zinc oxide nanocrystals

Zinc oxide nanocrystals (ZnO NCs), otherwise known as quantum dots (QDs) (NCs of size up to 10 nanometers), are now considered to be one of the most promising semiconducting nanomaterials. Their unique properties of ZnO NCs (tunable size, morphology, luminescence and electrical conductivity) strongly depend on the applied synthetic procedure and arise from the *quantum size effect* and the presence of defects, which can be achieved i.a. by the use of dopants (i.e. metal ions), i.e. intentionally incorporated impurities into the crystal lattice. Nevertheless, the design of metal-doped ZnO NCs (M-ZnO NCs) of desired quality remains challenging due to difficulties with strict control of particles growth. Recently developed in our group organometallic approach allows to achieve homogeneous ZnO NCs *via* slow transformation of alkylzinc derivatives of monoanionic organic ligands. The extension of our method *via* the rational-by-design of novel heterometallic precursors stabilized by monoanionic organic ligands could contribute to the precise control over the composition and the properties of M-ZnO NCs.

The aim of this project is to obtain lithium-containing zinc oxide nanocrystals (Li-ZnO NCs), what will be preceded by the synthesis of novel bimetallic (lithium-zinc) complexes supported by selected monoanionic organic ligands. The prepared well-characterized heterometallic compounds will be exploited as potential well-defined precursors of Li-ZnO NCs. The transformation to Li-ZnO NCs will be performed using wet-chemical as well as the solid state approach. Inherent part of all above-mentioned proposal will be the full characterization of obtained nanosystems *via* vast array of techniques and structure-property relationship study of obtained nanomaterials.

The presented project merges two fields: coordination chemistry of heterometallic complexes with materials science involving ZnO NCs. The results of this project should shed a new light on the interface between the transition from bimetallic complexes to nanocrystalline doped oxides. The project is also expected to open up new paths in rational-by-design of doped nanomaterials as functional materials for the application in spintronics, optoelectronics, photocatalysis or even biomedicine.