Advanced coordination materials designed on the basis of functional silsesquioxanes

Silsesquioxanes (SQs) are worldwide known organosilicon derivatives with nanosized and tailor-made three-dimensional structures. Their uniqueness results from the presence of inorganic siloxane Si-O-Si core and tunable functional organic coronae which classifies them as hybrid systems. These compounds attract great attention due to their exclusive properties derived from chemically and thermally robust organic-inorganic framework. This fact, along with the elaboration of synthetic routes for their functionalization, affects the broad area of their application.

There have been reports on the effective use of the inorganic Si-O-Si core as a scaffold for organic moieties playing ligand roles, to coordinate the metal ions and thus forming a specific type of coordination systems. This is a prospective area of functionalized silsesquioxanes application but still has been barely explored. Hence, the purpose and main scientific aim of the project ***"Advanced coordination materials designed on the basis of functional silsesquioxanes*"** is to design and develop synthetic strategies to obtain SQs-based coordination systems with diverse structure topology, exhibiting interesting physicochemical properties. The decisive feature of these studies lies in the wide range of functional silsesquioxanes differing in structure (from mono- to tetrafunctional cubic and double-decker SQs) that are planned to be used.

The proposed project will be realized in three MileStones (MSs). The MS1 is devoted to the design and syntheses of prefunctionalized silsesquioxanes, potential ligands based on arenes derivatives possessing heteroatoms and final anchoring of ligands on the respective SQs cores. The elaboration of efficient coordination strategies with selected transition metals ions (*d*- and *f*-block) that will result in the formation of SQs-based coordination systems, is the essence of the MS2. It is assumed that the obtained systems' frameworks will differ in resulting structure topology, from discrete molecules with no periodicity (0D) to periodicity in 1D (linear polymers) or 3D that refers to cross-linked networks. The inherent part of this proposal is a further characterization of the resulting materials in terms of their thermal, photophysical but also potential catalytic activity, which will be verified in the last MS3 of the project.

The implementation of this project may have a beneficial effect on the methodology of the synthesis of SQs-based coordination systems. This may also contribute to broadening knowledge about these compounds, mechanisms leading to their formation and interesting physicochemical properties. This extensive approach may shed light on a new direction of the exploitation of functionalized silsesquioxanes, as new building blocks of advanced organosilicon coordination systems, i.e. "*fine chemicals*".