

Project 3.19. Design and preparation of zinc oxide quantum dots for photovoltaic applications

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Background:

Quantum dots (QDs) are one of the most promising nanomaterials used in energy conversion technologies. They are characterized by extremely interesting electronic properties that can be easily modified through the direct control over their chemical composition, size and morphology as well as surface chemistry. Recently, our group has developed a convenient and general organometallic approach for the preparation of high-quality zinc oxide QDs coated with a densely-packed and highly-ordered organic shell composed of strongly surface-anchored monoanionic organic ligands - OSSOM (One-pot Self-Supporting OrganoMetallic approach) (Angew. Chem. Int. Ed. 2019, 58, 17163). The OSSOM process affords homogeneous and luminescent ZnO nanocrystallites with sizes defined in the so-called "quantum size regime" that are resistant toward both chemical and biological environments. What's more, this type of QDs exhibit unique physicochemical properties that make them very promising for a vast array of applications including photovoltaics and photocatalysis.

Aim:

The project will be focused on the development of novel organometallic approaches for the synthesis of ZnO QDs with desired physicochemical properties and their further use as electron transport layers in photovoltaic applications. The relationships between the properties of the resulting QDs and the electrical parameters of the obtained layers along with the solar cell efficiency are an inherent part of the study. The fabrication of solar cells will be carried out in a strong cooperation with the group of prof. Michael Graetzel (Ecole Polytechnique Fédérale de Lausanne).

Requirements:

- a university degree in chemistry,
- experience in laboratory work in the field of inorganic and coordination chemistry and/or semiconductor nanomaterials, experience with the use of a Schlenk line, knowledge of spectroscopic methods: IR, NMR, UV-Vis and/or basics X-ray crystallography and/or electron microscopy
- good command in English, communication skills and predispositions to work in a team