Challenges in design and synthesis of zinc oxide nanocrystalline materials for applications in planar and mesoporous perovskite solar cells

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Nanocrystalline zinc oxide (ZnO) has been widely recognised as a semiconducting nanomaterial with high electron mobility and band adjustable band gap, as such being a very promising material for constituting electron-transporting layer in perovskite solar cells in both planar and mesoporous architectures. However, due to difficulties with the synthesis of ZnO not exhibiting charge recombination, and high stability in connection with the perovskite layer, it is still challenging to construct highly efficient and stable ZnO-based cells.

We present a new organometallic synthetic approach, which enables the control of morphology, and physicochemical properties of ZnO nanocrystals by careful design of the organic-inroganic interface of its surface. As a proof of concept, we show stable oligoethylene glycol-coated ZnO nanocrystals, in which inorganic core-organic shell interface works as a hole stabilizer dramatically slowing down charge recombination process (recombination times up to microseconds).[1] Moreover, we present the synthetic approach leading to porous ZnO nanolayers for the application as scaffolds in perovskite solar cells. Finally, we will discuss the challenges in the preparation of functional solar devices incorporating the obtained materials.

1. A. M. Cieślak et al. *Nano Energy* **2016**, *30*, 187–192 .

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