

Zinc oxide nanocrystals: ultra-long recombination times, mechanosynthesis and mesoporous scaffolds for PSCs

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Zinc oxide was one of the first semiconductors used in dye-sensitized solar cells. In comparison to TiO₂, ZnO possesses a significantly higher electron mobility, which favours electron transport across its structures. However, at the same time, this property promotes charge separation and recombination, which is a significant disadvantage regarding efficacy of devices. Another significant drawback, which has so far precluded large-scale application of ZnO, is its poor chemical stability in aqueous acidic and basic media, which stems from its amphoteric properties. Overcoming these drawbacks cannot be possible without careful design and synthesis of ZnO-organic layer core-shell nanostructures.

We present new approaches to ZnO nanomaterials synthesis and functionalization aiming at increasing the effectiveness of ZnO application in solar devices. Firstly, we show new organometallic synthetic approach to obtain stable oligoethylene glycol-coated 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 Secondly, we aimed at using ZnO as scaffold material in solar devices; we combine a similar organometallic approach with a CO₂-fixation process to obtain ZnCO₃ and ZnO mesoporous nanostructures.² Thirdly, in search for environment-friendly way of synthesis of ZnO nanomaterials, we use mechanochemical transformations to obtain cyclodextrin-coated ZnO nanocrystals prone to transformation into mesoporous scaffolds.³ Finally, we will present perspectives of the obtained materials in construction of solar devices.

Références :

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2. K. Sokołowski et al. *Chem. Commun.* **2014**, *49*, 5271–5274.
3. P. Krupiński et al. *Chem. Eur. J.* **2016**, *22*, 7817–7823.

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