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Morphology Tuning of ZnO Nanostructures for Hybrid Solar Cells

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Hybrid solar cells have attracted great attention due to the advantages of their short payback time, high stability and flexibility, which results from the combination of inorganic and organic materials. For hybrid solar cells, DSSCs (solid-state dye-sensitized solar cells) and HBSCs (hybrid bulk-heterojunction solar cells) are mostly explored. For both of these kinds of solar cells, nanostructured ZnO is used as an electron transport material to provide a large interface area for exciton separation and electron extraction to their corresponding electrode. Therefore, the morphology of the ZnO films plays a critical role in improving the photovoltaic performance of ZnO based solar cells. Here, mesoporous ZnO nanostructures are synthesized via a diblock copolymer assisted sol-gel approach. For tuning the morphology of the ZnO films, characteristic parameters, such as the composite ratio of the materials, the deposition method, and the annealing temperature are investigated during synthesis. Subsequently, the surface morphology and the inner morphology are probed using scanning electron microscopy (SEM), atomic force microscopy (AFM) and grazing-incidence small-angle X-ray scattering (GISAXS), respectively. Based on controlled nanostructured ZnO films, all ssDSSCs or HBSCs are prepared and photovoltaic performance is investigated.

Primary authors: Ms TIAN, Ting (Institute of Functional Materials, Technische Universität München); Prof. MÜLLER-BUSCHBAUM, Peter (Institute of Functional Materials, Technische Universität München)

Presenter: Ms TIAN, Ting (Institute of Functional Materials, Technische Universität München)

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