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Morphology Control of Low Temperature Fabricated ZnO Nanostructures for Transparent Active Layers in All Solid-State Dye-Sensitized Solar Cells

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Dye-sensitized solar cells (DSSCs) offer outstanding potential due to their minor investment compared to inorganic solar cells and higher stability compared to organic solar cells. In this kind of cells, nanostructured inorganic metal oxides with tunable morphologies are of great importance. Among the many inorganic metal oxides, ZnO has been widely explored due to its outstanding electrical and optical properties and rich variety of morphologies. In order to improve the interfaces between ZnO and p-type polymers, routes to tune the length scales of the nanostructures are explored. The morphologies are probed using scanning electron microscopy (SEM) and grazing-incidence small-angle X-ray scattering (GISAXS). Through GISAXS measurement, the inner morphology, which is crucial for application in DSSCs, is probed. Based on the controlled nanostructured ZnO films, solid-state dye-sensitized solar cells (ssDSSCs) are prepared, for which every layer is deposited at low temperature to reduce the energy consumption of the manufacturing process. Transparent active layers for ssDSSCs are obtained, which demonstrates the possibility for building integrated solar cells.

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