Self-assembled 3D Host-Guests and TiO_2 fibrous network for enhanced charge transport and light harvesting in high efficiency solid-state dye-sensitized solar cells

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Conventional liquid electrolyte dye-sensitized solar cells (DSCs) have shown great promise thanks to their relatively low production cost, high efficiency, short payback time and use of readily available materials [1]. Recent industrialization of the fabrication process has renewed the case for all-solid devices that led to the development of dye-sensitized solar cells based on spiro-MeOTAD hole transport material. However, slow electron transport to the transparent electrode and high recombination rate have limited their thickness and, consequently, reduced their light harvesting capability and their overall efficiency. Herein, we present two novel morphologies for dye-sensitized solar cells based on the self-assembly of nanorods into a 3D fibrous network of fused single crystalline anatase nanowires and 3D host-guest approach. These architecture offers a high roughness factor, significant light scattering and up to several orders of magnitude faster electron transport to reach a near-record breaking conversion efficiency of 4.9% in solid state cells and record breaking photovoltages in liquid cells.

References

[1] Graetzel, M. The advent of mesoscopic injection solar cells. Prog Photovoltaics 14, 429-442, doi:10.1002/pip.712 (2006).