

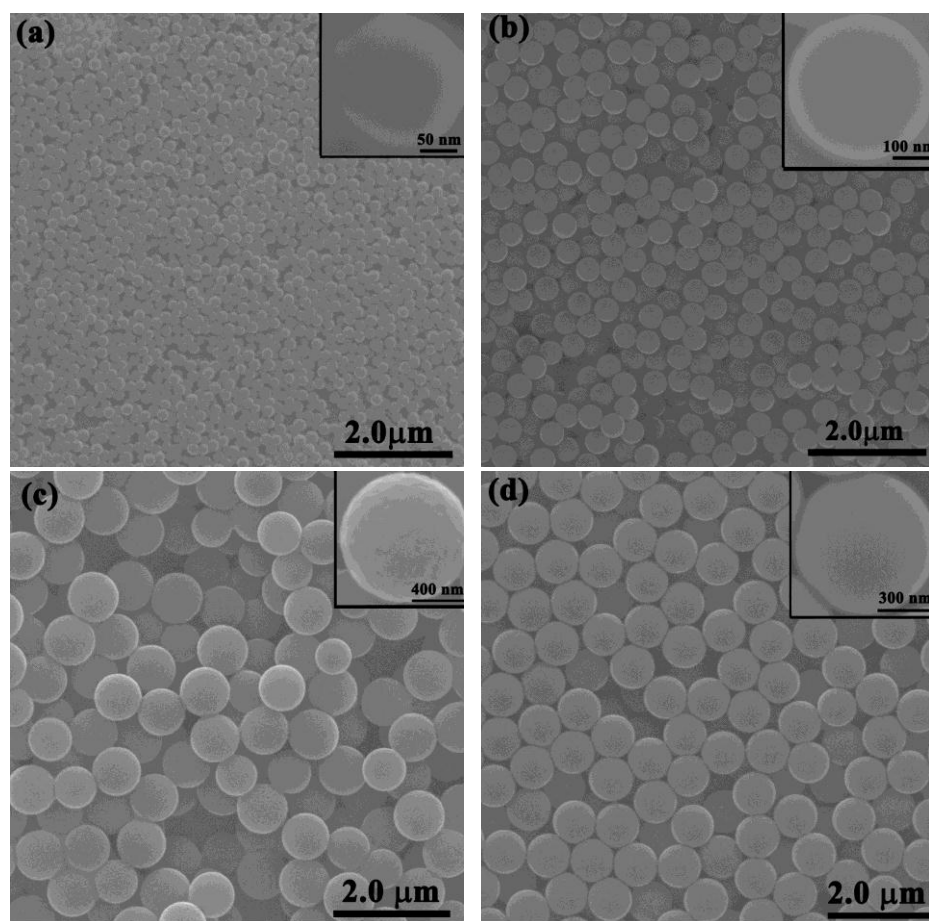
## Supporting Information

# Hydrothermal Fabrication of Hierarchically Macroporous $\text{Zn}_2\text{SnO}_4$ for Highly Efficient Dye-sensitized Solar Cells

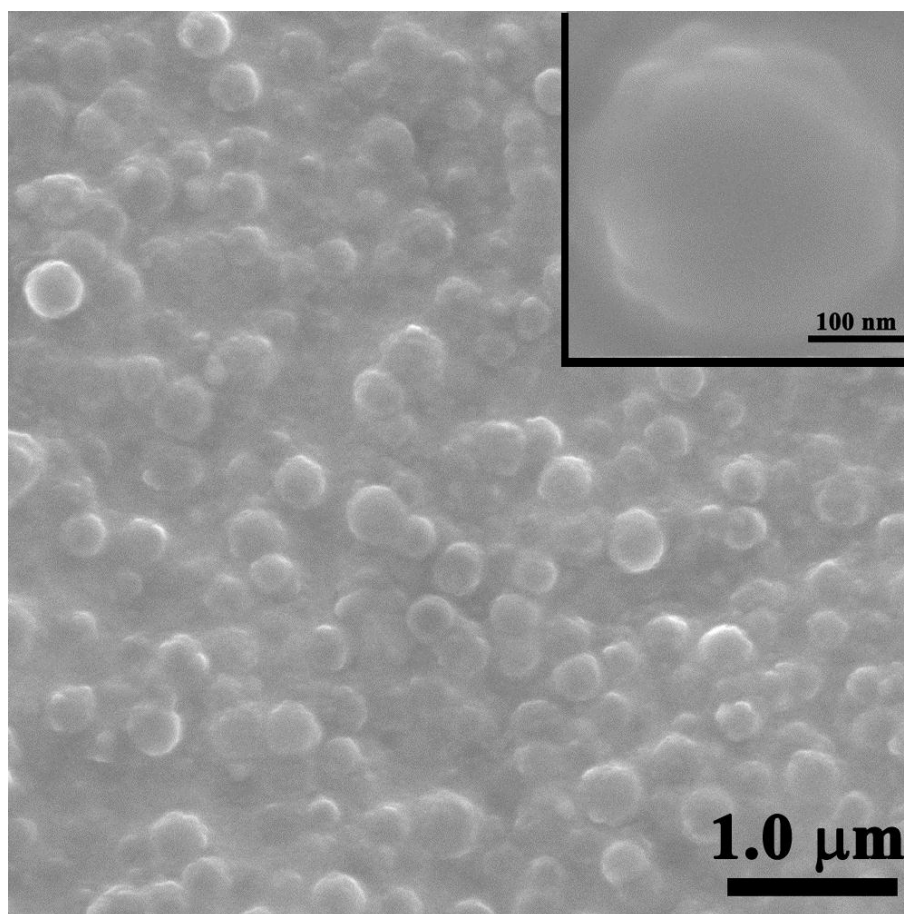
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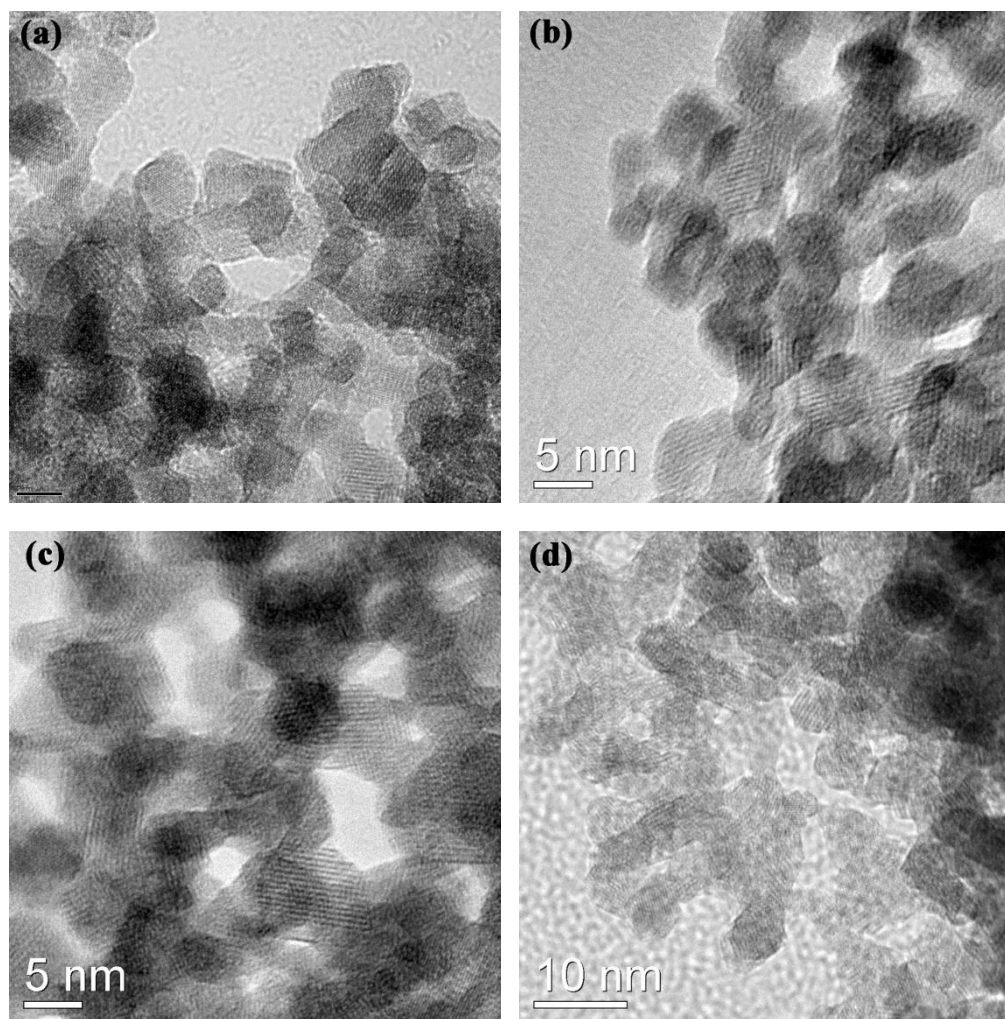
**Email:** [kuangdb@mail.sysu.edu.cn](mailto:kuangdb@mail.sysu.edu.cn).



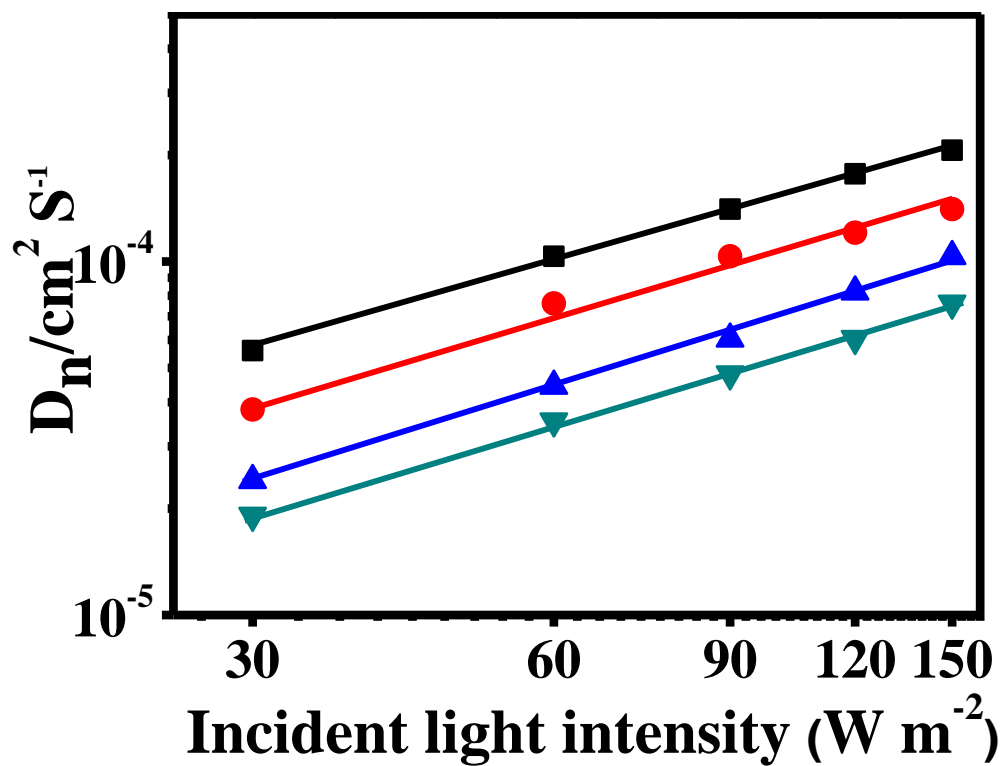
**Fig. S1** FE-SEM image of the PS: (a) 200 nm, (b) 400 nm, (c) 600 nm and (d) 750 nm. Insets are the corresponding high-magnification FE-SEM images.



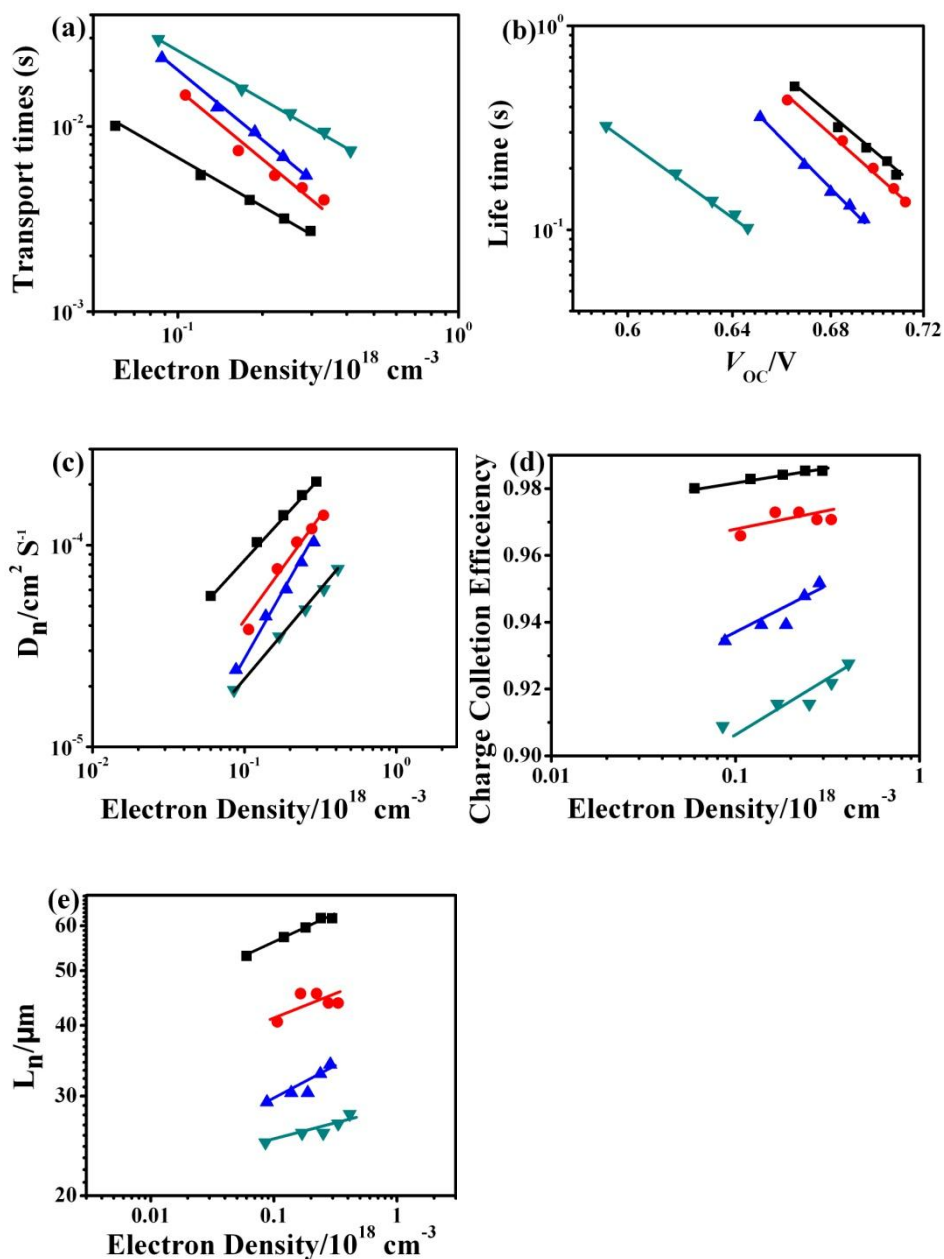
**Fig. S2** FE-SEM image of the PS@Zn<sub>2</sub>SnO<sub>4</sub> nanocrystal. Insets are the corresponding high-magnification FE-SEM images



**Fig. S3** High-magnification TEM images of Zn<sub>2</sub>SnO<sub>4</sub> NPs of different sizes of macroporous Zn<sub>2</sub>SnO<sub>4</sub>: (a) **I**, (b) **II**, (c) **III** and (d) **IV**.

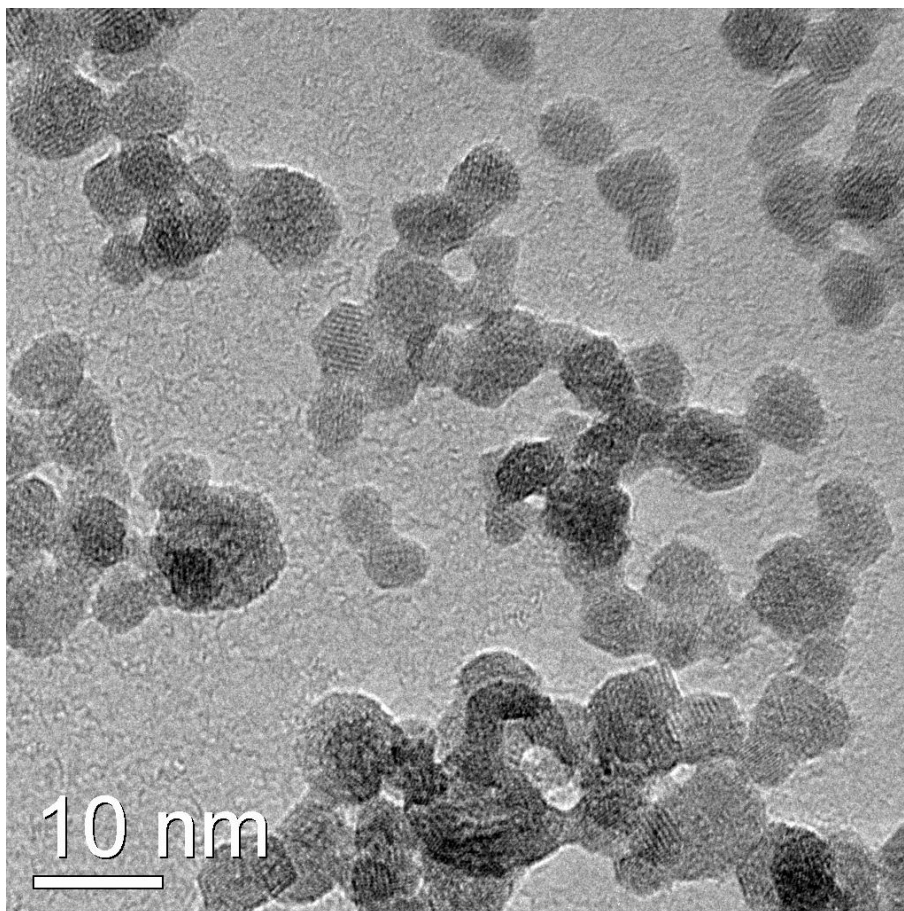


**Fig. S4** The electron diffusion coefficient of DSSCs based on different  $\text{Zn}_2\text{SnO}_4$  photoelectrodes,  $\blacksquare$ : I,  $\bullet$ : II,  $\blacktriangle$ : III and  $\blacktriangledown$ : IV.

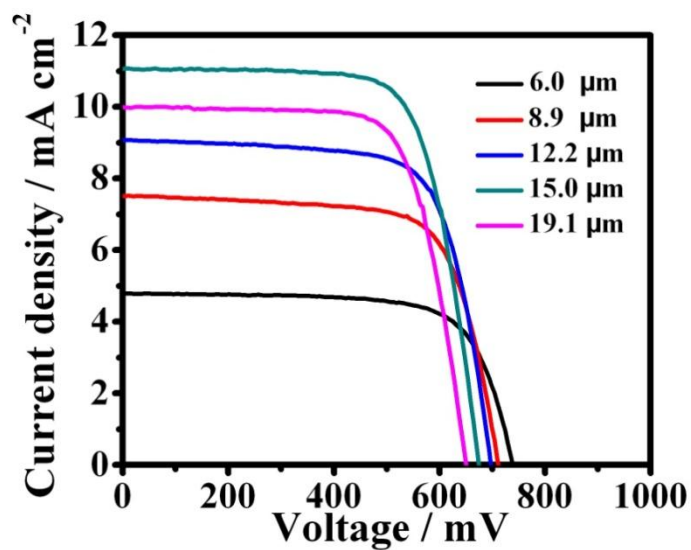


**Fig. S5** (a) The electron transport time as a function of photoelectron density, (b) electron recombination time constant as a function of open-circuit voltage under different light intensity, (c) electron diffusion coefficient as a function of photoelectron density, (d) electron collection efficiency as a function of photoelectron density, and (e) effective electron diffusion length as a function of photoelectron density. The DSSCs based on different hierarchical macroporous Zn<sub>2</sub>SnO<sub>4</sub> photoelectrodes with the film thickness of ~15 μm, ■: 180 nm, ●: 375 nm, ▲: 550 nm and ▼: 650 nm.





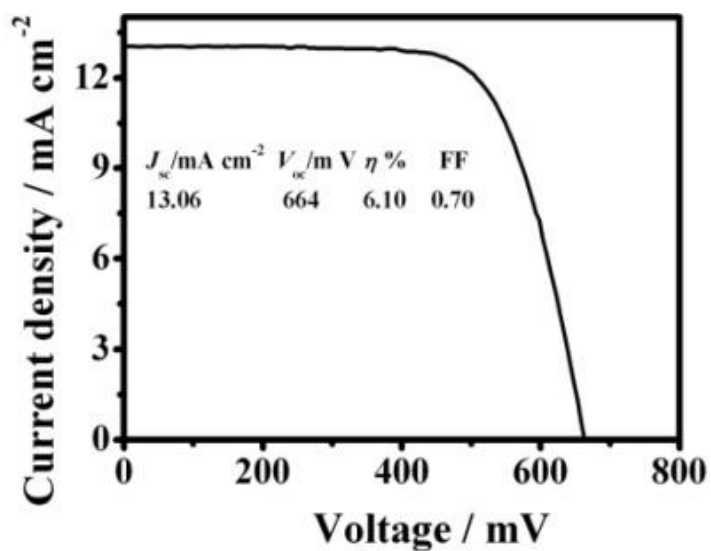
**Fig. S6** High-magnification TEM images of Zn<sub>2</sub>SnO<sub>4</sub> NPs prepared via the hydrothermal process in the absence of PS spheres.



**Fig. S7** Photocurrent density-voltage ( $J$ - $V$ ) curves of the DSSCs based 4.2 nm  $Zn_2SnO_4$  nanoparticle with different thicknesses.

**Table S1.** Detailed photovoltaic parameters ( $J_{sc}$ ,  $V_{oc}$ , FF, and  $\eta$ ) of dye-sensitized 4.2 nm  $Zn_2SnO_4$  nanoparticle solar cells with different thicknesses.

Film thickness / $\mu\text{m}$	$J_{sc}$ / $\text{mA cm}^{-2}$	$V_{oc}$ / mV	$\eta$ / %	FF
6.0	4.79	739	2.54	0.72
8.9	7.29	713	3.75	0.72
12.2	9.07	697	4.51	0.71
15.0	11.05	674	5.36	0.72
19.1	9.99	650	4.67	0.72



**Fig. S8** Photocurrent density-voltage ( $J$ - $V$ ) curves of the DSSCs based on a double layer photoelectrode consisting of 4.2 nm  $\text{Zn}_2\text{SnO}_4$  nanoparticle (15  $\mu\text{m}$  in thickness) and 180 nm  $\text{Zn}_2\text{SnO}_4$  macropore (4  $\mu\text{m}$  in thickness).