Electronic Supplementary Information

for

Formation of Size-tunable Dandelion-like Hierarchical Rutile Titania Nanospheres for Dye-sensitized Solar Cells

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Table S1. Photovoltaic parameters of devices with Z907 dye made of TiO_2 scatter pastes – ED25, ED20, ED15, ED10 and ED5 with the same fabricated TiO_2 films (14+5 μm) without $TiCl_4$ post-treatment under simulated AM-1.5G one-sun illumination (power 100 mW cm^{-2}) and active area 0.16 cm^2.

DHRS LSL	J_{SC} /mA cm^{-2}	V_{OC} /mV	FF	η /%
ED5	13.7	820	0.750	8.4
ED10	13.6	814	0.758	8.4
ED15	14.0	809	0.740	8.4
ED20	14.1	807	0.759	8.6
ED25	14.0	795	0.759	8.5

Table S2. Photovoltaic parameters of DSSC with devices made of Z907 dye and various scattering TiO_2 pastes – PST-400C, 18NR-AO, R/SP and ED20 – with the $TiCl_4$ post-treatment under simulated AM-1.5G illumination (power 100 mW cm^{-2}) and active area 0.16 cm^2 with a shadow mask 0.25 cm^2.

LSL	Working Electrode[a]	J_{SC} /mA cm^{-2}	V_{OC} /mV	FF	η /%
PST-400C	*a*	15.2	819	0.750	9.3
	b	15.3	823	0.743	9.4
	c	15.4	819	0.733	9.2
	average	15.3±0.2	820±5	0.742±0.02	9.3±0.2
18NR-AO	*a*	15.1	799	0.760	9.2
	b	15.3	795	0.749	9.1
	c	15.0	800	0.763	9.2
	average	15.1±0.3	798±5	0.757±0.01	9.2±0.1
R/SP	*a*	14.7	813	0.762	9.1
	b	15.2	816	0.731	9.1
	c	14.6	823	0.747	9.0
	average	14.8±0.6	817±10	0.747±0.03	9.1±0.1
ED20	*a*	15.3	803	0.754	9.3
	b	15.5	806	0.755	9.4
	c	15.6	801	0.740	9.2
	average	15.5±0.3	803±5	0.750±0.02	9.3±0.2

[a] All TiO_2 working electrodes (labeled as *a*-*c*) were fabricated under the same experimental conditions; the uncertainties represent one standard deviation.

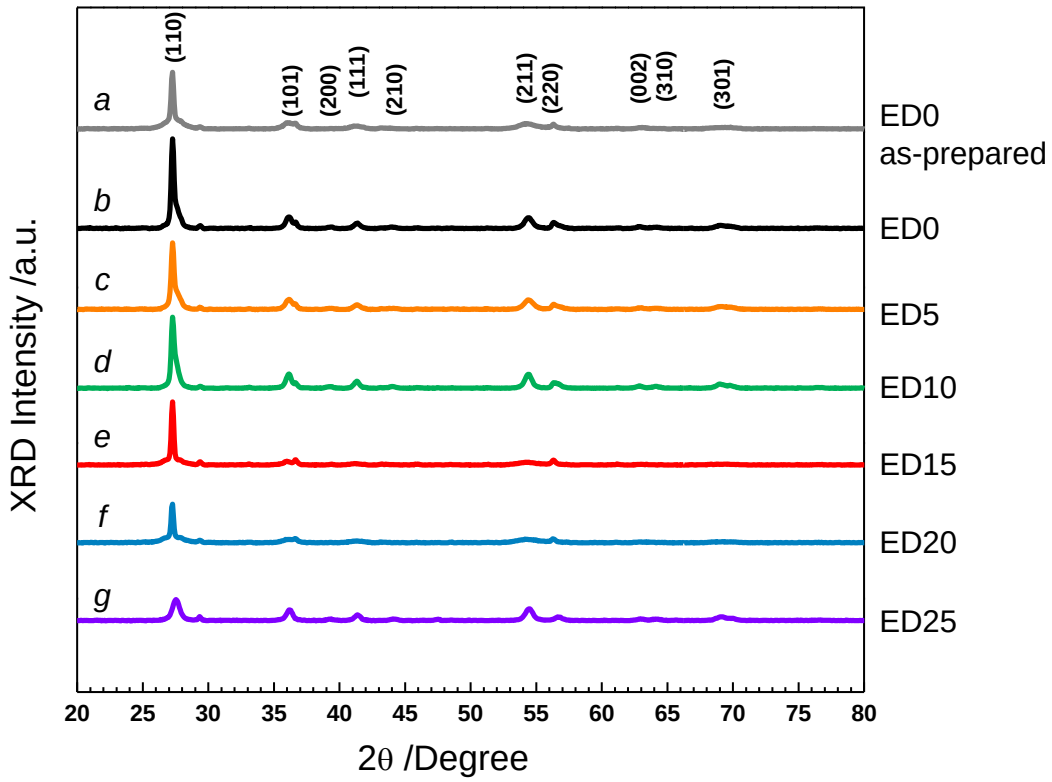

Figure S1. XRD patterns of TiO_2 dandelion-like hierarchical rutile spheres (DHRS) of ED0, ED5, ED10, ED15, ED20 and ED25 shown as traces *a*-*g*. Trace *a* represents ED0 as prepared without annealing and traces *b*-*g* represent ED0-ED25 with annealing at 500 °C for 30 min.

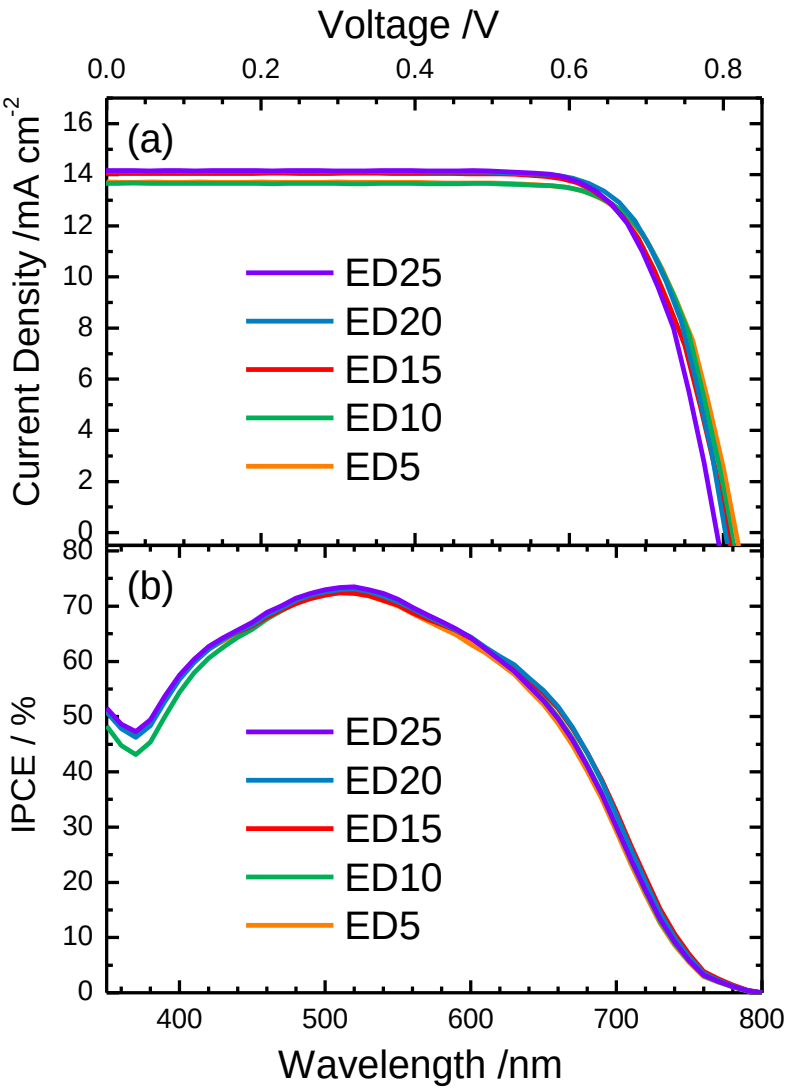

Figure S2. (a) current-voltage characteristics and (b) corresponding IPCE action spectra of devices with Z907 made of various TiO_2 DHRS scatter pastes, ED25, ED20, ED15, ED10 and ED5 with the same double-layer structural TiO_2 films (14+5 μm) fabricated under the same conditions and one-sun AM-1.5G irradiation.

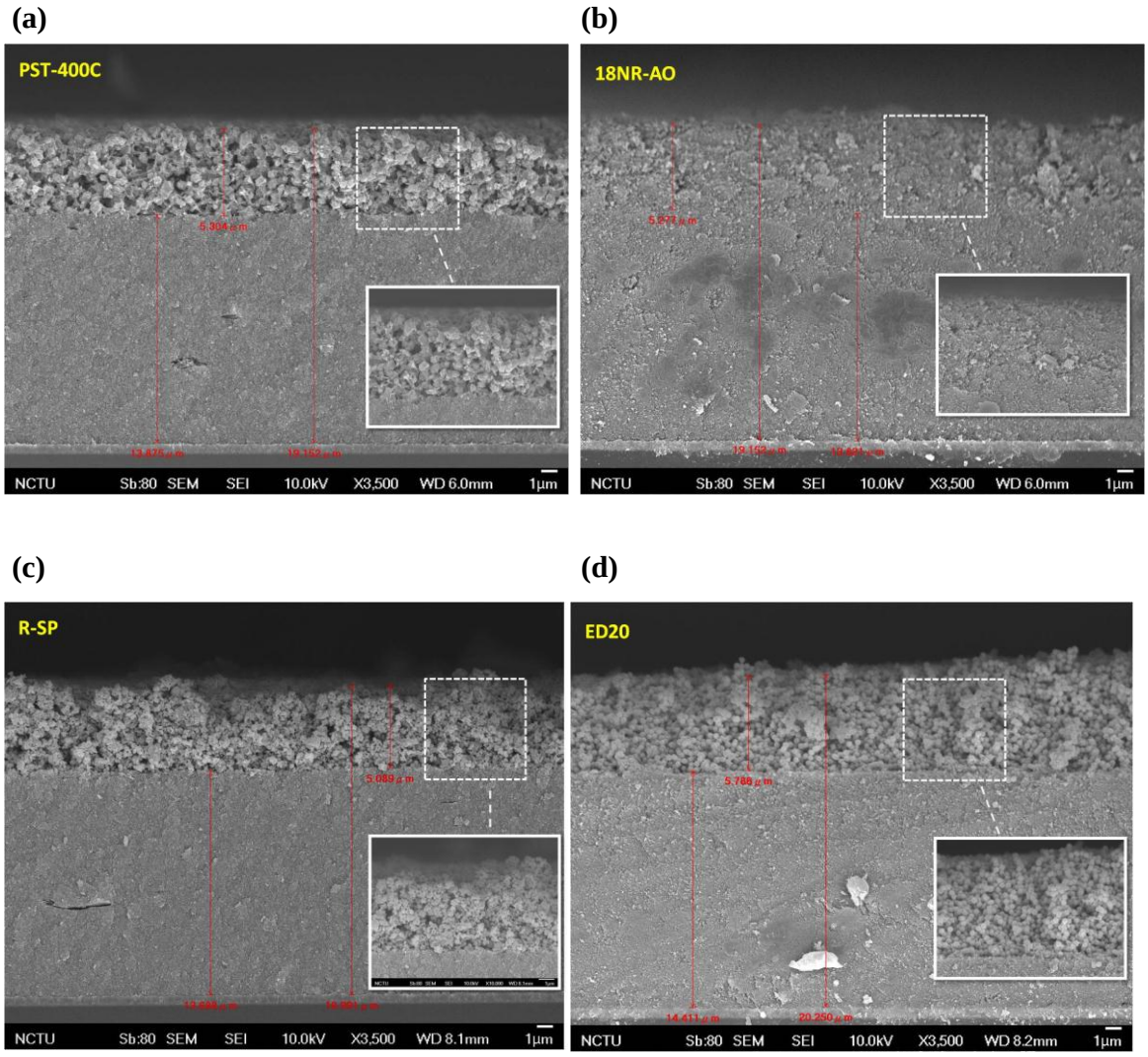

Figure S3. Side-view SEM images of the TiO_2 films with varied LSL of (a) PST-400C, (b) 18NR-AO, (c) R/SP and (d) ED20 coated on top of a transparent TiO_2 active layer (AL) showing the double-layer structure with the film thicknesses of ~5 μm and ~14 μm for LSL and AL, respectively.

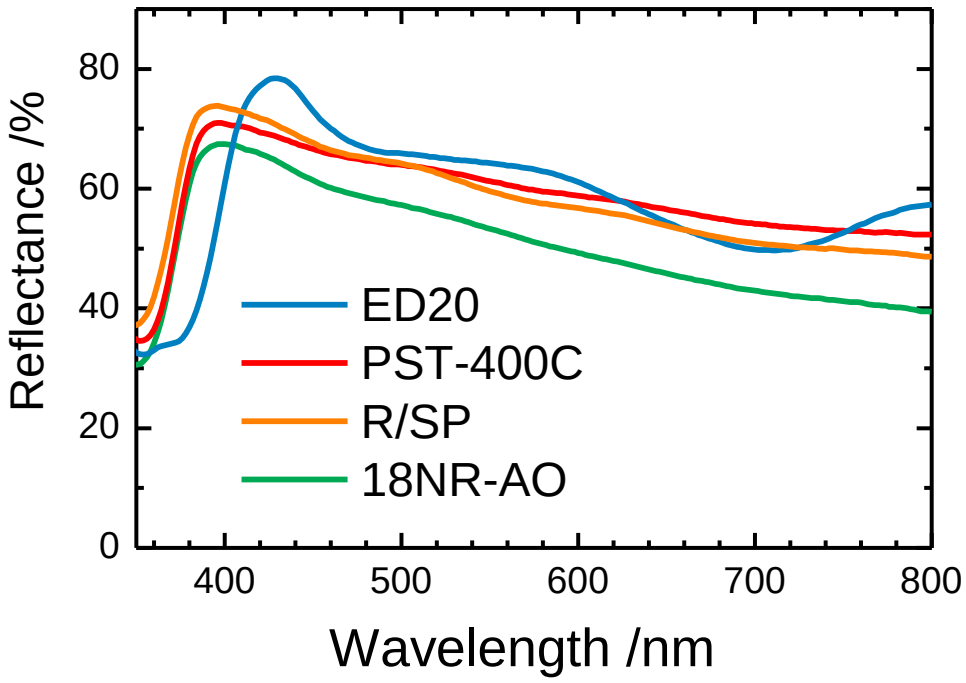

Figure S4. Thin-film reflectance spectra of ED20, PST-400C, R/SP and 18NR-AO.