Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.


Supporting Information

# Probing Photovoltaic Performance in Copper Electrolyte Dye-Sensitized Solar Cells of Variable $TiO_2$ Particle Size Using Comprehensive Interfacial Analysis

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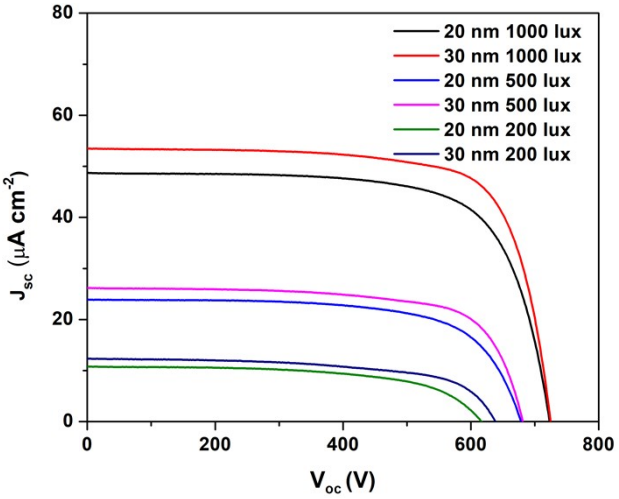


**Figure S1.** Current density - voltage (*J-V*) of DSCs fabricated with 20 nm and 30 nm $TiO_2$ particles employing D35 sensitizer and $[Cu(tmby)_2]^{2+/1+}$ redox mediator under cfl light.

**Table S1**. Indoor photovoltaic parameter of DSCs fabricated with 20 nm and 30 nm $TiO_2$ particles employing D35 sensitizer and $[Cu(tmby)_2]^{2+/1+}$ redox mediator under cfl light.

| Device | Input power lux (μW/cm²) | $V_{oc}$ (mV) | $J_{sc}$ (μA/cm²): | *FF* | $P_{max}$ (μW/cm²) | PCE (%) |
|---|---|---|---|---|---|---|
| 20 nm | 1000 (283) | 722 ± 1 | 48.68 ± 0.26 | 71.08 ± 0.33 | 25.01 ± 0.31 | 8.83 ± 0.11 |
| | 500 (143) | 679 ± 4 | 23.92 ± 0.23 | 66.97 ± 0.37 | 10.88 ± 0.23 | 7.61 ± 0.16 |
| | 200 (59) | 617 ± 2 | 10.79 ± 0.22 | 59.71 ± 0.25 | 3.98 ± 0.27 | 6.74 ± 0.14 |
| 30 nm | 1000 (283) | 727 ± 3 | 53.74 ± 0.22 | 75.14 ± 0.45 | 29.36 ± .74 | 10.37 ± 0.26 |
| | 500 (143) | 687 ± 3 | 26.54 ± 0.20 | 73.95 ± 0.80 | 13.49 ± 0.20 | 9.43 ± 0.14 |
| | 200 (59) | 639 ± 2 | 12.33 ± 0.10 | 61.43 ± 0.55 | 4.84 ± 0.33 | 8.21 ± 0.22 |

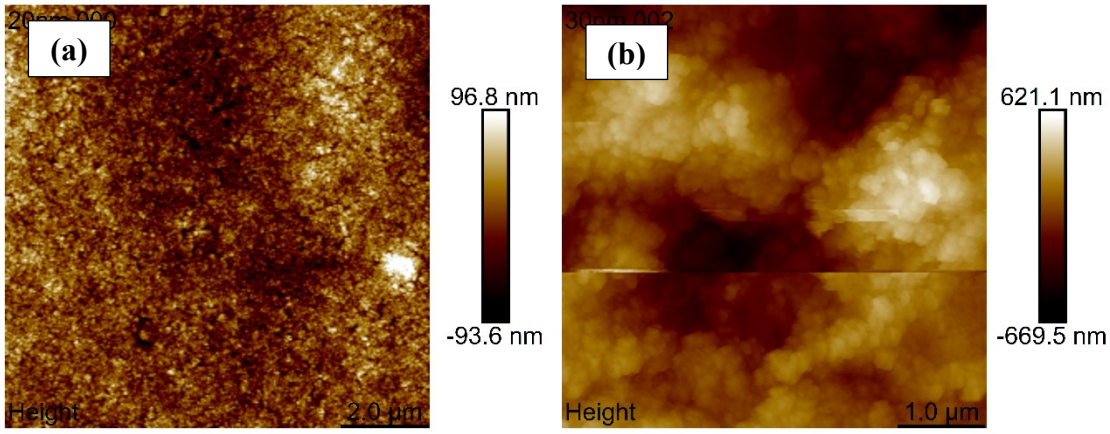


**Figure S2.** AMF image of $TiO_2$ film with **(a)** 20 nm **(b)** 30 nm diameter.

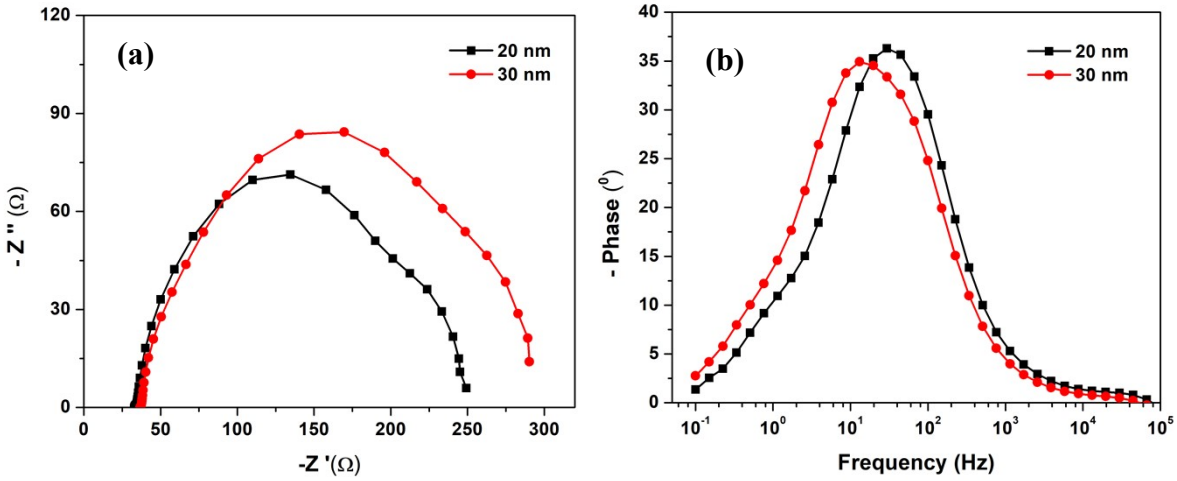


**Figure S3**. **(a)** Nyquist plot and **(b)** Bode plot of DSCs fabricated with 20 nm and 30 nm $TiO_2$ particles

EIS was measured at open circuit potential for both DSC with $TiO_2$ praricle 20 nm and 30nm.Figure S2 (a) and (b) displays Nyquist plot and bode plot.The Nyquist plot consists of three distinquished semicircle,the semicircle at high frquency region corresponds to charge trasfer at counter electrpode electrolyte interface,second semicircle corresponds to charge transfer at $TiO_2$/electrolyte interface and the third semicircle corresponds to diffusion of ions on electrolyte.As seen in Figure S2 (a) the radius of second semicircle of 30 nm device is larger than 20 nm device which shows higher recombination resistance in 30 nm device than 20 nm device.We calculated lifetime ($\tau_n$) form Bode plot using the relation, $\tau_n=1/2\pi f_{max}$ where $f_{max}$ is frquency at hightest phase value. 30 nm device showed lifetime of 5.3 ms while 20 nm device showed 12.1 ms.

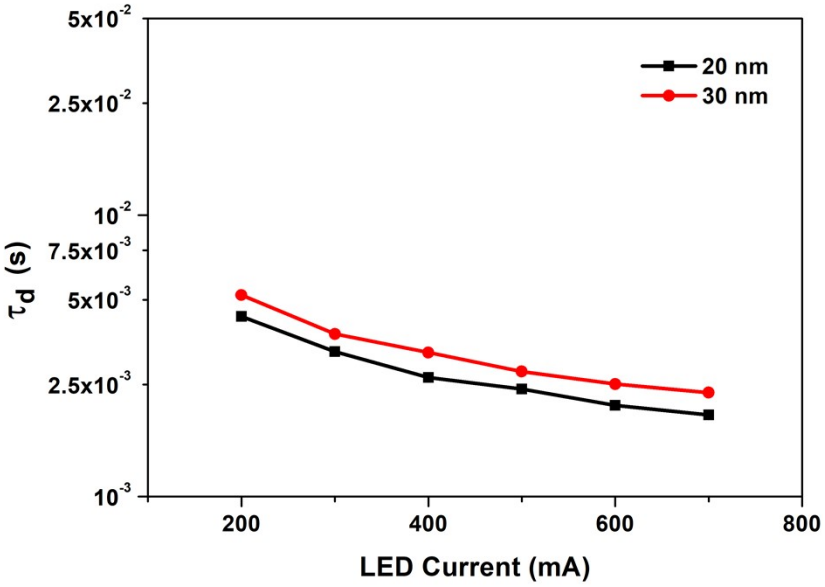


**Figure S4**. Transport time ($\tau_d$) measurements using transient photocurrent decay for DSCs with 20 nm and 30 nm $TiO_2$ particles.