

Supporting Information

Surface Engineered Angstrom Thick ZnO-sheathed TiO₂ Nanowires as Photoanode for Performance Enhanced Dye-sensitized Solar Cells

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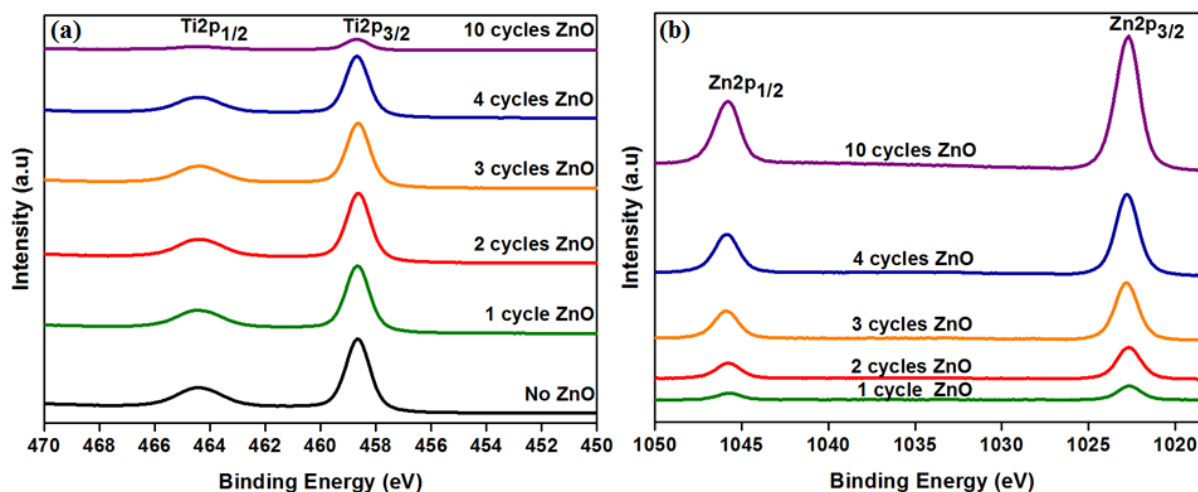


Fig. S1 XPS spectra of a) Ti2p and b) Zn2p for TiO₂-ZnO core-shell

Time-Resolved Single Photon Counting (TRSPC) Measurement

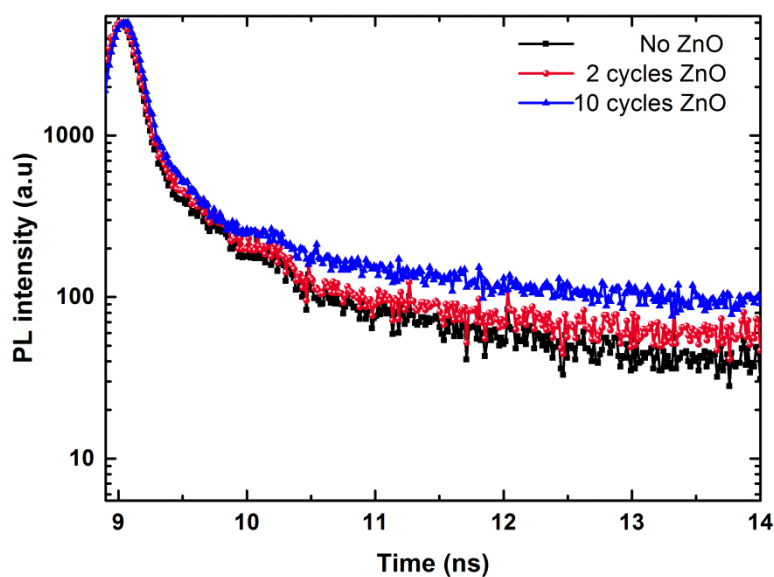


Fig. S2 Excited state electron radiative decay of N719 dye sensitizer for 0, 2 and 10 cycles ZnO coated TiO₂ NWs for an excitation of 370 nm.

Dye Adsorption Measurements

The amount of dye adsorbed to the electrodes is measured by a Microplate Reader, Spectramax M5. For desorption of dye N719 from the surface, 1 : 1 ethanol–0.1 M NaOH solution is prepared. For obtaining calibration curve of dye, 5 different dye concentration (75, 62.5, 50, 25, 10, and 5 μ M in 1 mL) are prepared and each sample immersed in 1mL of 1:1 ethanol–0.1 M NaOH solution for desorption of the dye. According to the N719 dye spectrum max absorption is observed at 378 nm and 514 nm.

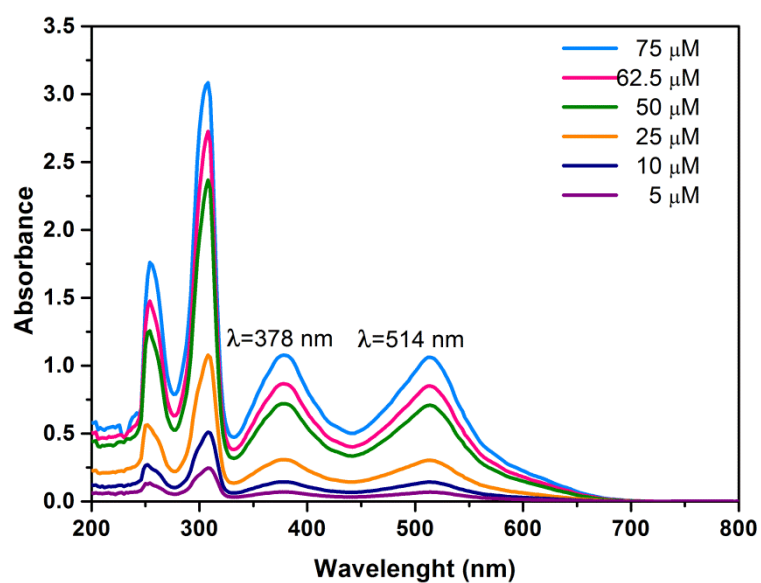


Fig. S3 UV-Vis absorption spectrum of N719 sensitizer dye

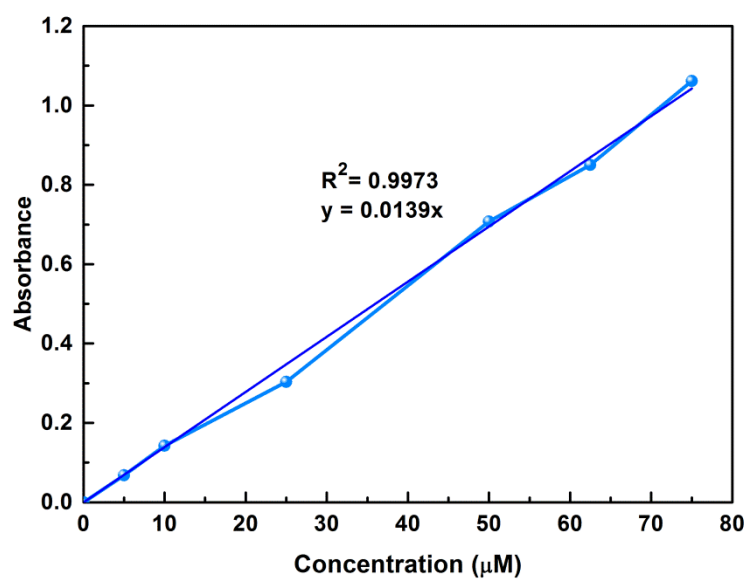


Fig. S4 Concentration versus absorbance graph of N719 at 514 nm.

X-Ray Photoelectron Spectroscopy (XPS)

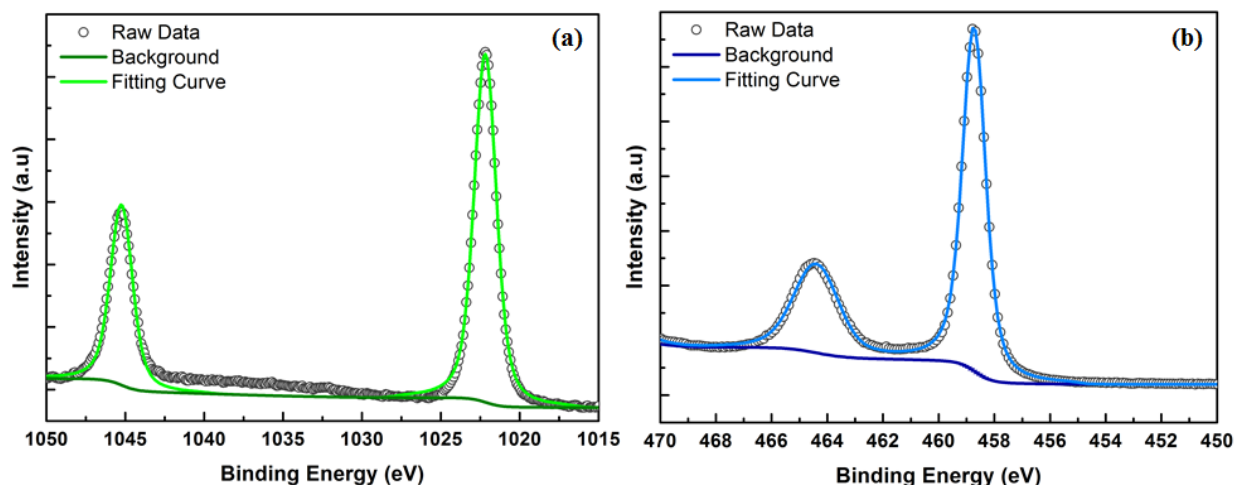


Fig. S5 CLs of a) Zn $2p_{3/2}$ and b) Ti $2p_{3/2}$ recorded on TiO_2 –ZnO heterojunction. All peaks have been fitted to Voigt line shapes using a Shirley background, and the VB values are determined by linear extrapolation of the leading edge to the baseline.

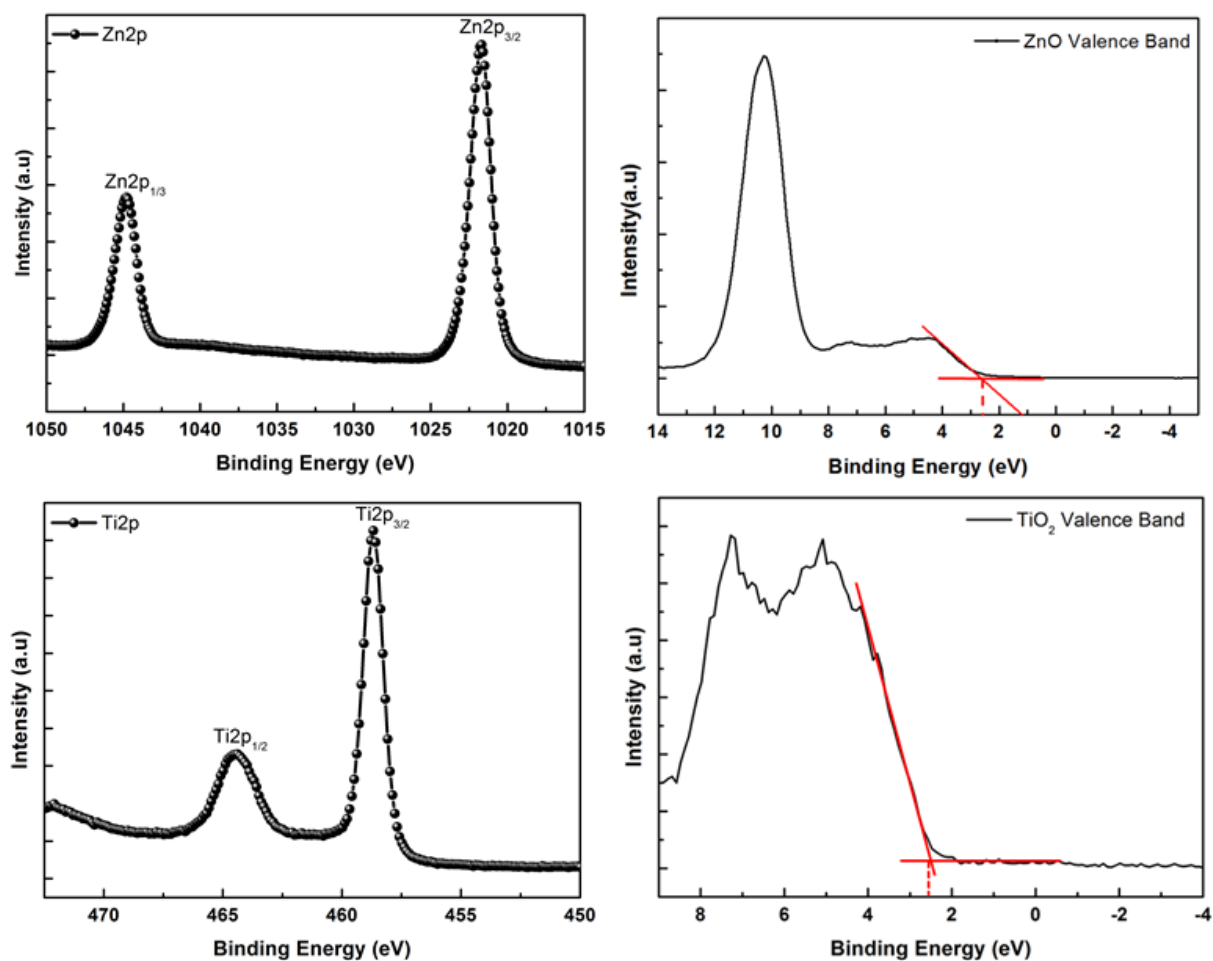


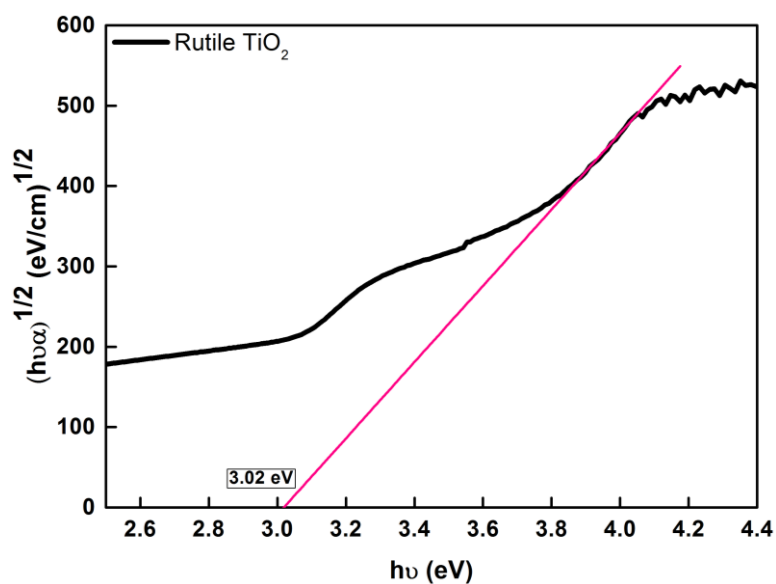
Fig. S6 CLs and VB Spectra of Zn $2p_{3/2}$ and Ti $2p_{3/2}$ recorded on pure ZnO and TiO_2 samples (VBM values are determined by extrapolating of leading edge to the base line.)

Table S1. Atomic concentrations extracted from XPS survey scans

# of ZnO ALD cycles	Ti 2p %	O 1s %	Zn 2p %	C 1s %	Zn/(Ti+Zn)%
0	30.49	62.54	-	6.96	0
1	26.41	55.37	2.71	15.51	9.30
2	26.37	58.32	5.88	9.42	18.23
3	24.02	54.47	9.41	12.1	28.15
4	23.12	55.26	13.67	7.96	37.16
10	11.33	40.18	41.07	7.42	78.38

Transmission Measurements

By using transmission data getting from UV-Vis-NIR Spectroscopy, the bandgap of TiO₂ can be experimentally determined by extrapolating the line portion of the plot $(\alpha h\nu)^{1/2}$ versus $h\nu$ by using Kubelka–Munk function. Fig. S6 presents the estimated value of the optical gap to be 3.02 eV for the bare rutile TiO₂ NW arrays calculated from the curves.

**Fig. S7** $(\alpha h\nu)^{1/2}$ versus $h\nu$ plot for the bare rutile TiO₂ structure.