Electronic Supplementary Information for Journal of Materials Chemistry A

Electronic Supplementary Information

Highly efficient aqueous-processed polymer/nanocrystals hybrid solar cells with aqueous-processed TiO_2 electron extraction layer

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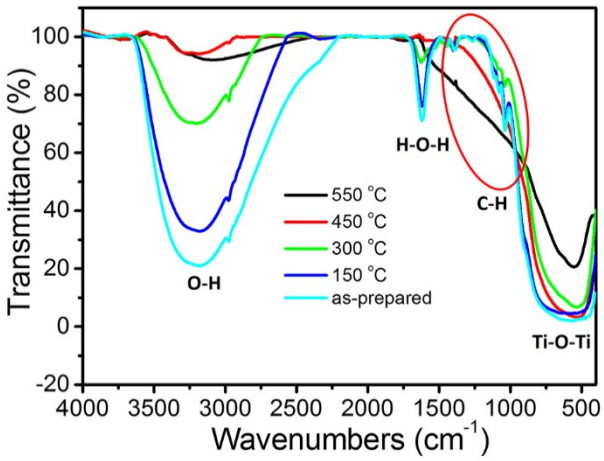

Fig. S1. FTIR spectra of TiO_2 NCs annealed at different temperature. The strong absorption around 450 cm^{-1} and 3200 cm^{-1} is attributed to the vibration of Ti-O-Ti and O-H bonds, respectively. The sharp absorption at 1619 cm^{-1} corresponds to the vibration of absorbed H_2O molecule. The slight absorption between 1000 and 1500 cm^{-1} is assigned to the vibration of C-H bond, which originates from absorbed organic solvent. When annealing temperature exceeds 450 ^oC, the disappear of absorption peaks for the vibration of H_2O, O-H and C-H indicates the desorption of H_2O and organic solvent and decomposition of hydroxyl.

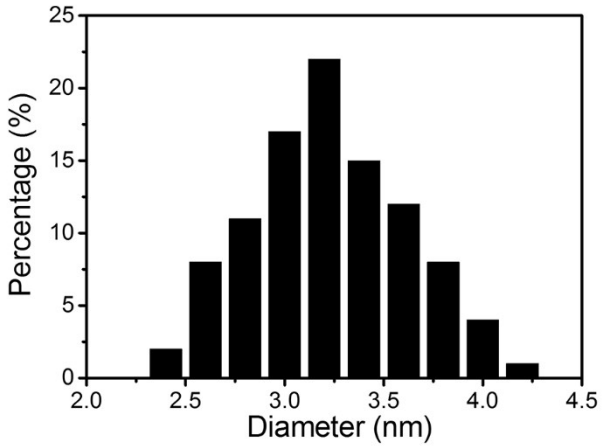

Fig. S2. The statistics of particle size for the as-prepared TiO_2 NCs. The average size is 3.0 nm.

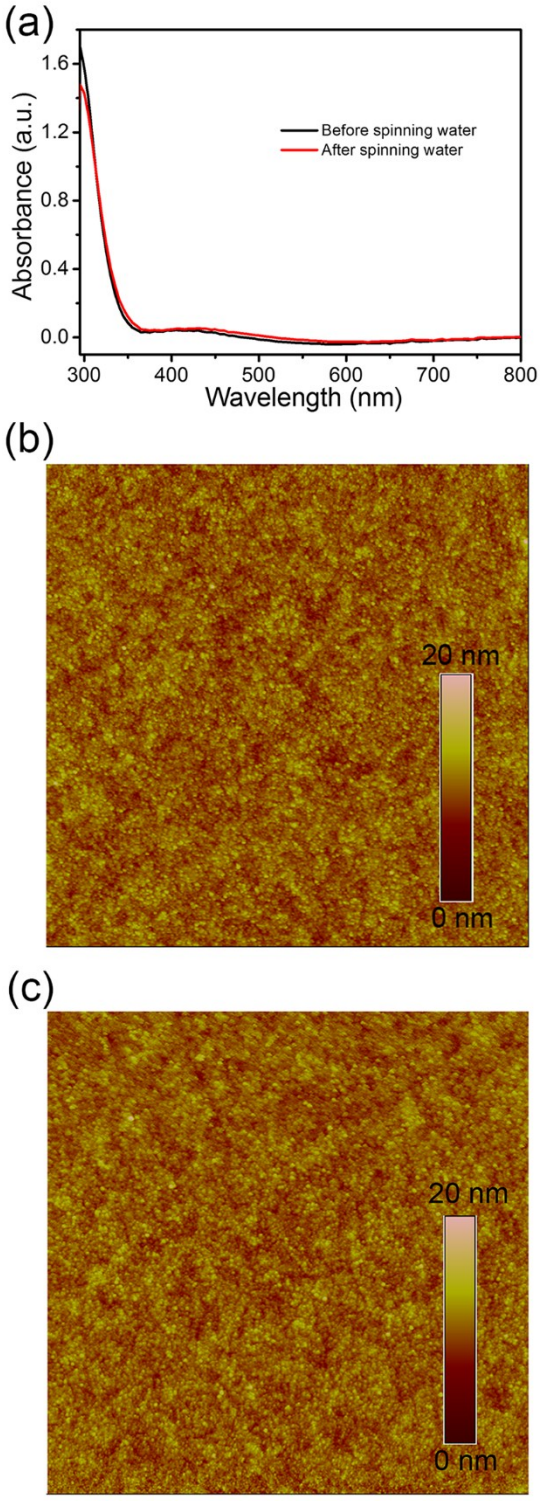

Fig. S3. (a) The absorption spectra of aqueous-processed TiO_2 film annealed at 450 ^oC before and after spinning water. AFM images (5 µm × 5 µm) of aqueous-processed TiO_2 NCs films before (b) and after (c) spinning water.

Table S1 Photovoltaic performance of HSCs with different thickness TiO_2 buffer layer annealed at 450 °C, under the illumination of AM1.5G, 100 mW cm^{-2}. The data are the average values obtained from 6 devices.

thickness	*Jsc* (mA/cm2)	*Voc* (V)	FF	PCE (%)	Rs (Ωcm2)	Rsh (Ωcm2)
25 nm	15.06 (±0.64)	0.569 (±0.03)	47.4 (±2.3)	4.06 (±0.35)	12.3 (±2.3)	572.9 (±57.2)
40 nm	15.43 (±0.84)	0.581 (±0.02)	51.8 (±2.1)	4.64 (±0.26)	12.7 (±1.9)	680.3 (±68.9)
70 nm	14.03 (±0.91)	0.564 (±0.02)	48.7 (±3.1)	3.85 (±0.37)	13.0 (±2.1)	312.5 (±62.3)

Table S2 Photovoltaic performance of optimized HSCs with 40 nm TiO_2 buffer layer annealed at different temperature, under the illumination of AM1.5G, 100 mW cm^{-2}. The data are the average values obtained from 6 devices.

annealing temperature	*Jsc* (mA/cm2)	*Voc* (V)	FF (%)	PCE (%)	Rs (Ωcm2)	Rsh (Ωcm2)
150 °C	15.44 (±0.46)	0.380 (±0.02)	33.5 (±1.2)	1.93 (±0.37)	9.1 (±2.1)	65.2 (±27.3)
300 °C	15.24 (±0.57)	0.556 (±0.01)	25.2 (±3.4)	2.18 (±0.32)	66.3 (±8.5)	168.5 (±77.1)
450 °C	15.14 (±0.19)	0.624 (±0.02)	57.2 (±2.1)	5.29 (±0.24)	9.5 (±2.6)	1004 (±34.7)
550 °C	16.06 (±0.91)	0.579 (±0.02)	42.7 (±2.0)	3.97 (±0.33)	9.2 (±2.0)	213.0 (±67.5)

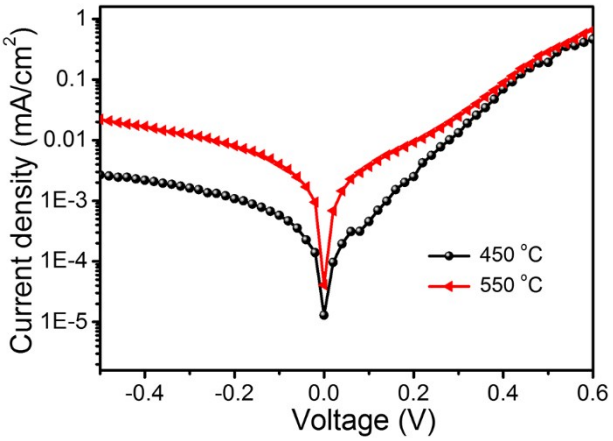

Fig. S4. J-V characteristics of HSCs with aqueous-processed TiO_2 buffer layer annealed at 450 °C and 550 °C in the dark.

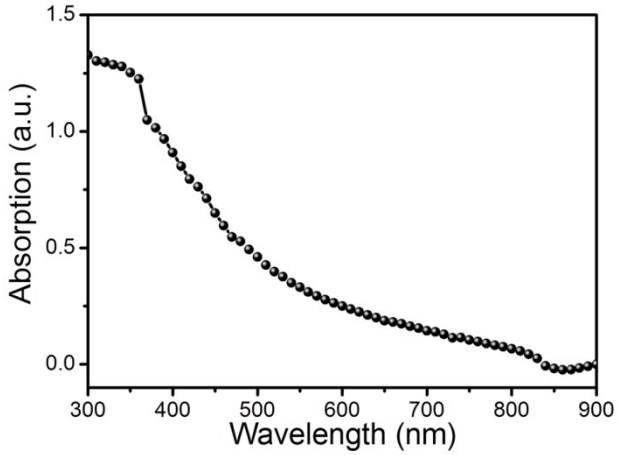

Fig. S5. Absorption spectrum of the aqueous-processed polymer/CdTe hybrid solar cells.

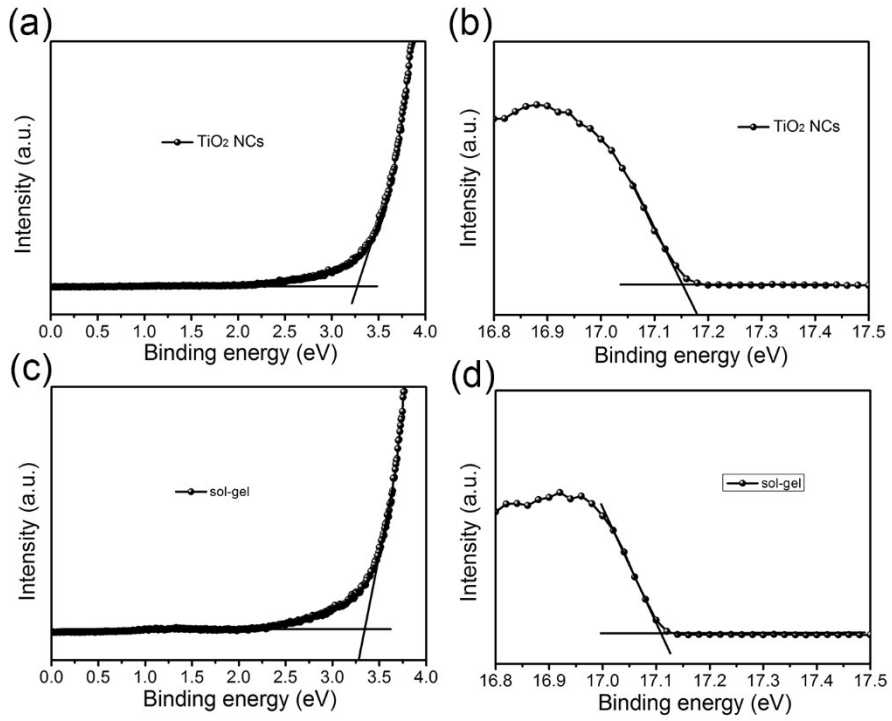

Fig. S6. The UPS spectra of the aqueous-processed TiO_2 (a)-(b) and Sol-gel TiO_2 (c)-(d) film.

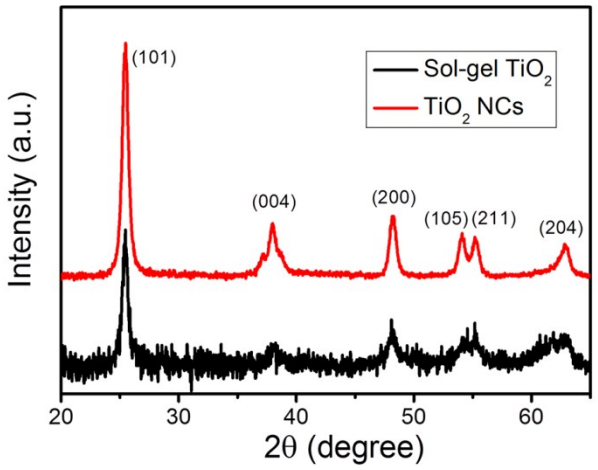

Fig. S7. XRD of the TiO_2 NCs and Sol-gel TiO_2 annealed at 450 ^oC.

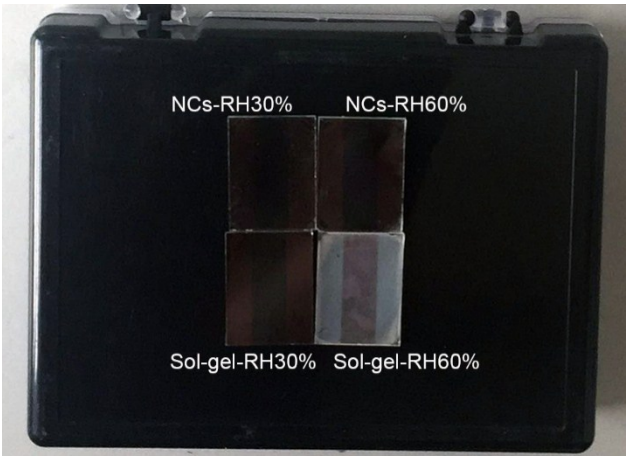

Fig. S8. Photographs of the aqueous-processed TiO_2 and Sol-gel TiO_2 film deposited in different RH.