# Supporting Information

# High-performance of $TiO_2$/CdS quantum dot sensitized solar cells with a Cu-ZnS passivation layer

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**Experimental section:**

**QDSSC fabrication:** Anatase $TiO_2$ particles (20 nm, Ti-Nanoxide HT/SP, Solaronix) paste was spread onto conductive fluorine-doped tin oxide (FTO) substrate by the doctor blade method and sintering the samples at 450 $^0$C for 30 min. Afterwards, CdS was deposited on the surface of $TiO_2$ by facile SILAR process similar to a previously published procedure was used [15]. The passivation layer Cu-ZnS was deposited on $TiO_2$/CdS by SILAR, using cationic precursor aqueous solution of 15 mM $CuSO_4 \cdot 5H_2O$ and 0.1 M $Zn(CH3COO)_2 \cdot 2H_2O$, an anionic precursor aqueous solution of 0.1 M $Na_2S$, dipping for 2 min in each solution. The as-prepared photoanode is names as $TiO_2$/CdS/Cu-ZnS photoanode. The QDSSC was assembled into a

sandwich of photoanode and CuS as a counter electrode, which are separated by sealant (SX 1170-60, Solaronix). DI water:methanol (7:3 by volume) solution as a co-solvent of the polysulfide electrolyte (1 M $Na_2S$, 2 M S, and 0.1 M KCl), which was used to fill the space between the electrodes.

**Characterization:** The morphology of the samples surface was examined by scanning electron microscope (SEM, S-2400, Hitachi). The crystalline structure of thin films was investigated by X-ray diffraction (XRD, D/Max-2400, Rigaku). The composition of elements in sample was studied by X-ray photon spectroscopy (XPS, ESCALAB 250 operated at 1486.6 eV). The optical absorption spectra were obtained by UV–vis spectroscopy (OPTIZEN 3220UV spectrophotometer). Current–voltage (J–V) characteristics were recorded under one sun illumination (AM 1.5 G, 100 mW $cm^{-2}$) using an ABET Technologies (USA) solar simulator. EIS was investigated using a BioLogic potentiostat/galvanostat/EIS analyzer (SP-150, France) under one sun illumination with a frequency of 100 mHz-500 kHz and 10 mV of AC amplitude.

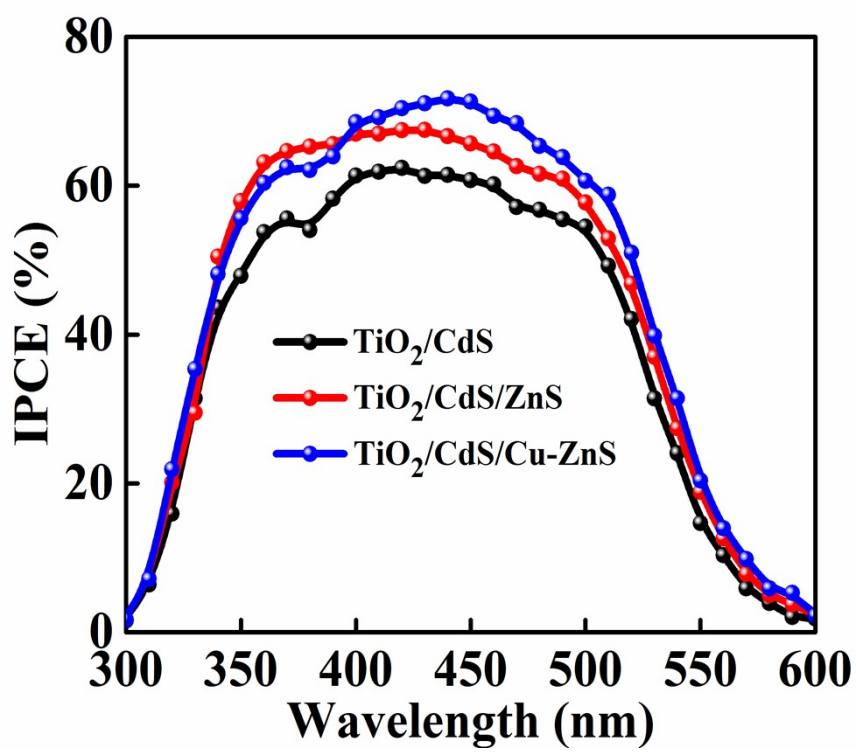


**Fig. S1** Incident photon-to-current conversion efficiency (IPCE) spectra of $TiO_2$/CdS, $TiO_2$/CdS/ZnS and $TiO_2$/CdS/Cu-ZnS QDSSCs.