Electronic Supplementary Information

High Contrast Photoelectrochromic Device with CdS Quantum Dot Sensitized Photo-anode

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1. Chemical composition analysis

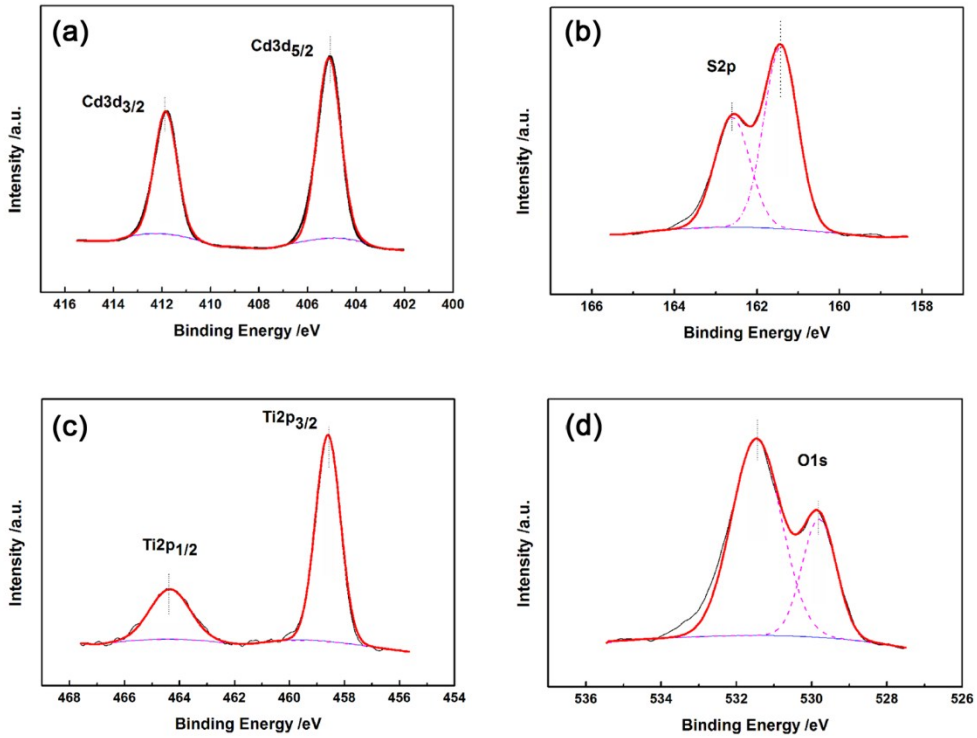

Fig. S1. XPS spectra of (a) Cd 3d, (b) S 2p, (c) Ti 2p and (d) O 1s peaks in CdS(6)/TiO_2 photo-anode. The detected data and fitting results are drawn with black and red lines, respectively.

The presence of CdS on the prepared PA electrode was confirmed by means of XPS. As shown in Fig. S1, elements of Cd, S, Ti and O are observed. The fine doublet located at 405.11 eV and 411.85 eV, as shown in Fig. S1a arise from a spin-orbit interaction with the Cd($3d_{5/2}$) and Cd($3d_{3/2}$), respectively.[1] The binding energy of S 2p shown in Fig. S1b is 161.42 eV, which indicates the CdS chemistry.[1] Additionally, Ti^{4+} is further proved to exist in the PA anode from the signal peaks of Ti $2p_{1/2}$ of 464.35 eV and Ti $2p_{3/2}$ of 458.60 eV as shown in Fig. S1c.[2] The main peak of O 1s at 531.47 eV in Fig. S1d could be attributed to the metallic oxide.

2. Time behaviour

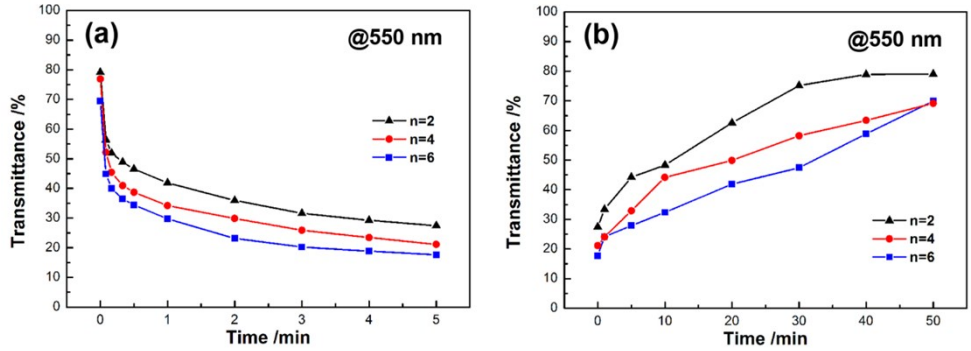

Fig. S2. The photoelectrochromic response behaviour of QDS-PECD(n) in coloring and discoloring process at 550 nm. n stands for the deposition layer of CdS QDs. All the data are collected in-situ under AM 1.5 illumination at 100 mW/cm^2.

3. Photoelectrochromic cycle stability

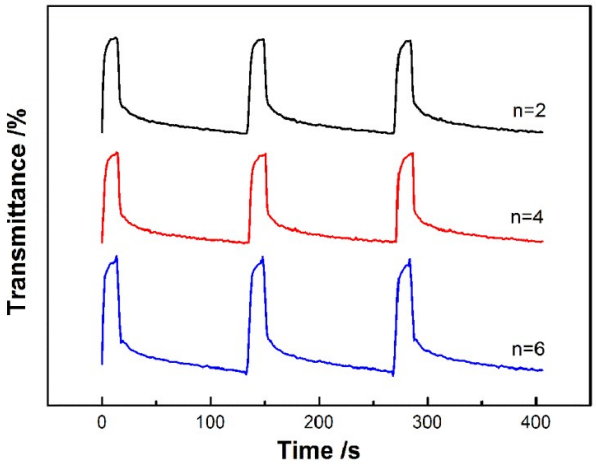

Fig. S3. Several photoelectrochromic cycles of QDS-PECD(n) monitored at 700 nm. All the data are collected in-situ under illumination.

Fig. S3 shows several photoelectrochromic cycles of QDS-PECD(n) monitored at 700 nm. As discoloring process takes too much time, the coloration processes of all the QDS-PECD were self-powered for 120 s and the discoloring processes were carried out by applying external bias of +1 V for 15 s in each cycle. This result indicates the devices' potential for practical applications.

References:

1. S. S. Mali, H. Kim, P. S. Patil and C. K. Hong, *Dalton Trans.*, 2013, **42**, 16961-16967.

2. G. Luo, K. Shen, J. Zheng and C. Xu, *J. Mater. Chem. C*, 2016, **4**, 9085-9093.