Electronic Supplementary Information

Highly efficient CdS/CdSe-sensitized solar cells controlled by the structural properties of compact porous TiO₂ photoelectrodes

Quanxin Zhang, Xiaozhi Guo, Xiaoming Huang, Shuqing Huang, Dongmei Li, Yanhong Luo, Qing Shen, Taro Toyoda and Qingbo Meng

a Beijing Laboratory for Condensed Matter Physics, Institute of Physics, Chinese Academy of Sciences, Beijing, 100190, China. Email: qbmeng@iphy.ac.cn, dmli@iphy.ac.cn; Tel & Fax: 86-10-82649242.

b Department of Engineering Science, Faculty of Informatics and Engineering, The University of Electrocommunications, 1-5-1 Chofugaoka, Chofu, Tokyo 182-8585, Japan. Email: toyoda@pc.uec.ac.jp; Tel: 81-424-43-5471, Fax: 81-424-43-5501.

c PRESTO, Japan Science and Technology Agency, 4-1-8 Honcho Kawaguchi, Saitama 332-0012, Japan. Email: shen@pc.uec.ac.jp
Characterization

The absorption and desorption data were analyzed using the BJH (Barrett, Joyner and Hanlenda) method for incremental pore volume distribution on ASAP 2020 apparatus, Micromeritics. The optical absorptions of TiO$_2$ electrodes with CdS/CdSe QDs were studied by Photoacoustic (PA) technique on a lab-made PA setup.$^1$ The sample was sealed in a PA cell and illuminated by monochromatic light modulated with a 500W Xe arc lamp and mechanical chopper. The microphone, preamplifier and lock-in amplifier were used to monitor the PA signal. The PA spectrum was carried out in the wavelength range of 300~ 800 nm and normalized with a PA spectrum of carbon black sheet.$^1$

Figure S1. BJH desorption pore size distribution curves of different monolayers T (a), S1(b), S2(c) and S3 (d). Inset graph: the N$_2$ adsorption-desorption isotherm linear plots of each film.
Figure S2. Normalized photoacoustic (PA) spectra of T and TS1 films after QDs deposition.

The PA method can figure out the optical absorption of opaque and scattered samples since the PA signal is directly proportional to the thermal energy, which is derived from the optical absorption in nonradiative processes.\(^2\)\(^-\)\(^3\) Figure S2 depicts the normalized PA spectra of T and TS1 films after being assembled with CdS/CdSe QDs. The size of CdSe particles is estimated at 5.8 nm by using empirical equations proposed by Toyoda and Peng \textit{et al}.\(^4\)\(^-\)\(^5\) This indicates that the same QDs growth rate occurred for photoanodes with or without light scattering film.

References: