

**Electronic Supporting Information (ESI)**

**Surface engineering of PbS quantum dot sensitized solar cells with a conversion efficiency exceeding 7%**

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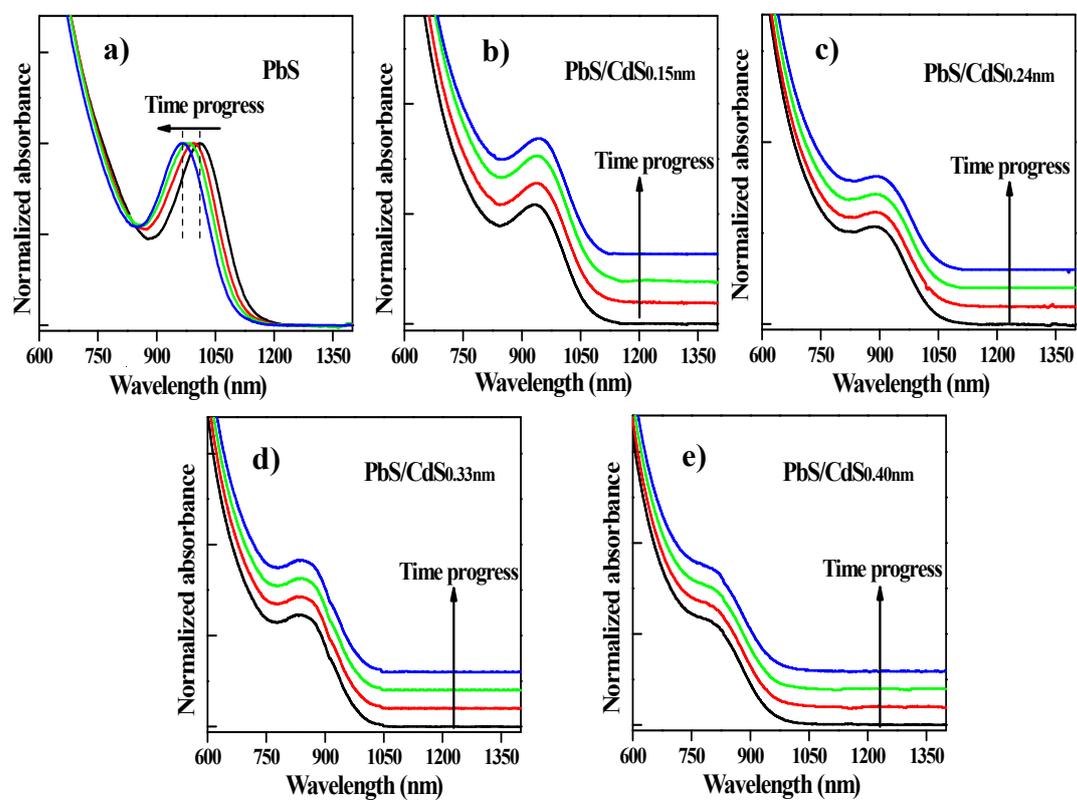
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### **Preparation of TGA-capped water-soluble QDs**

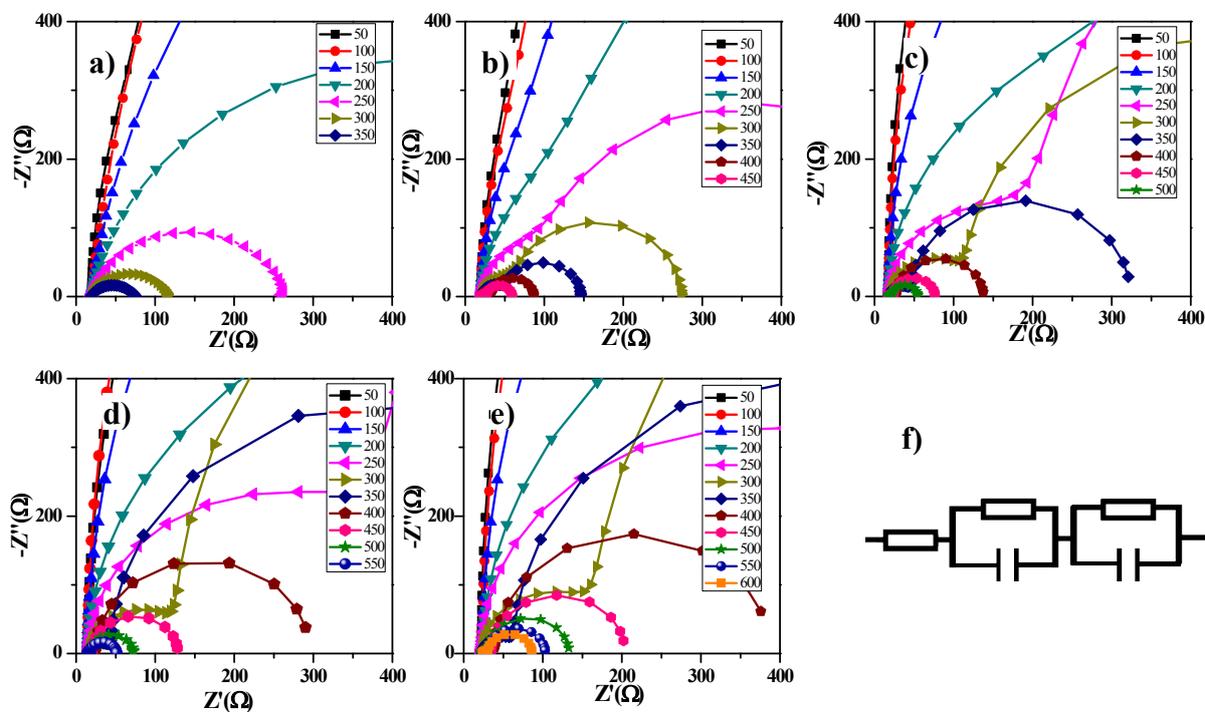
The water solubilization of the as-prepared oil-soluble QDs was achieved by the ligand exchange procedure according to literature method.<sup>1-2</sup> Typically, 1.0 mL of methanol containing 0.13 mL of TGA was adjusted PH = 8 with 30% NaOH, and then it was injected into the 5 mL of QDs-toluene solution, and stirred for 10min. 15.0 mL of deionized water was added into the mixture and kept stirring for another 5 min. The solution was separated into two phases finally and the QDs was transferred into the superincumbent water from the reaction solution. The free TGA ligand in the QD aqueous solution was isolated by precipitating the QDs with addition of acetone. The pellet was then re-dissolved in 2 mL of deionized water and adjusted PH = 9 with 30% NaOH.

**Table S1** The Pb/Cd ratios of the core/shell PbS/CdS QD samples determined by ICP-AES.

QDs	Pb/Cd
PbS/CdS <sub>0.15nm</sub>	1/0.38
PbS/CdS <sub>0.24nm</sub>	1/0.71
PbS/CdS <sub>0.33nm</sub>	1/1.12
PbS/CdS <sub>0.40nm</sub>	1/1.58



**Fig. S1** Absorption spectra of (a) PbS, (b) PbS/CdS<sub>0.15nm</sub>, (c) PbS/CdS<sub>0.24nm</sub>, (d) PbS/CdS<sub>0.33nm</sub> and (e) PbS/CdS<sub>0.40nm</sub> dispersed in toluene, recorded at different times after synthesis: 0 (black), 1 (red), 2 (green), and 4 weeks (blue).



**Fig. S2** Impedance characterization under dark for Nyquist curves under different bias voltages for PbS (a), PbS/CdS<sub>0.15nm</sub> (b), PbS/CdS<sub>0.24nm</sub> (c), PbS/CdS<sub>0.33nm</sub> (d) and PbS/CdS<sub>0.44nm</sub> (e) based QDSCs. The fitting equivalent circuit for impedance spectroscopy (f).

## References

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- 2 J. W. Yang, T. Oshima, W. Oshima, Z. X. Pan, X. H. Zhong, Q. Shen, *J. Mater. Chem. A*, 2014, **2**, 20882.