Supplementary Information

Influence of Deposition Strategies on CdSe Quantum Dot-Sensitized Solar Cells: A Comparison Between Successive Ionic Layer Adsorption and Reaction and Chemical Bath Deposition

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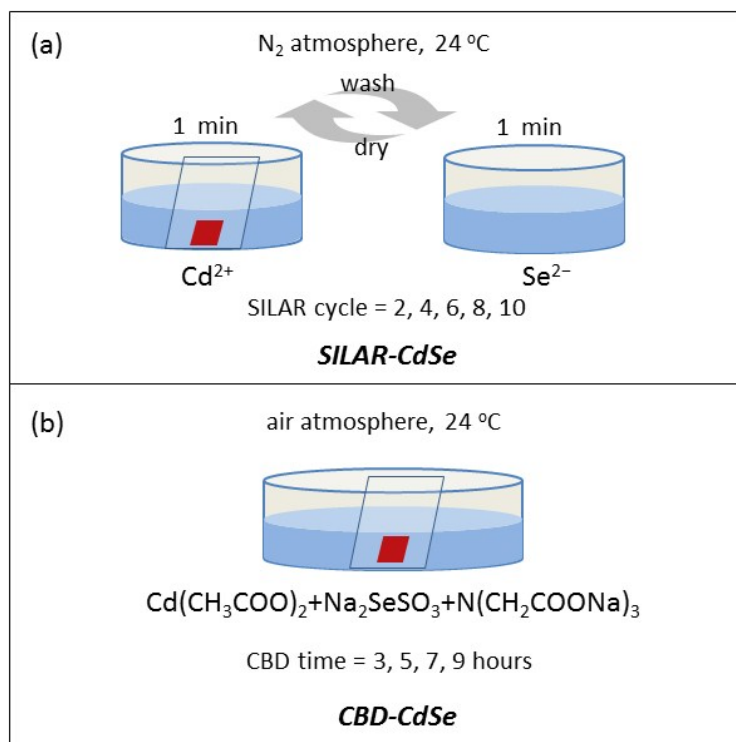
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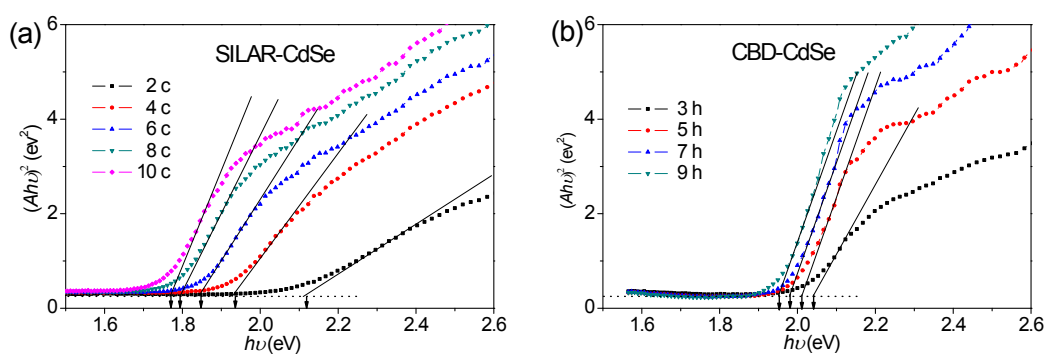
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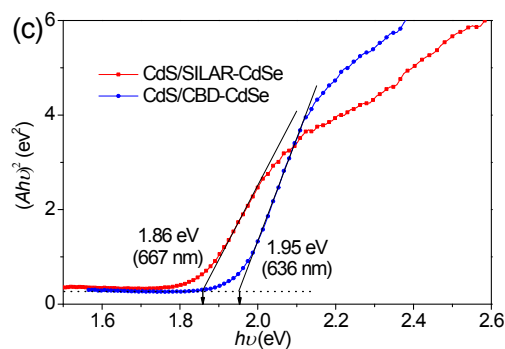E-mail: gzcao@u.washington.edu (G.Z. Cao).

1. Typical procedures for SILAR and CBD processes to deposit CdSe QDs

Scheme S1 Schematic illustrations of the typical procedures for (a) SILAR and (b) CBD processes to deposit CdSe QDs.

2. Absorption onset, effective band gap and band gap shift of CdSe QDs

Fig. S1 $(Ah\upsilon)^2$ vs $h\upsilon$ plots for determining the absorption onsets and effective band gap of the CdSe QDs prepared by (a) SILAR for various cycle number, (b) CBD for different deposition hours and (c) CdS seeded SILAR and CBD, respectively.

Table S1 Absorption onset, effective band gap and band gap shift of CdSe QDs obtained prepared by (a) SILAR for various cycle number and (b) CBD for different deposition hours, respectively. ΔE is the band gap blue shift with respect to that of bulk CdSe (1.74 eV)

(a) SILAR−CdSe	2 cycles	4 cycles	6 cycles	8 cycles	10 cycles
absorption onset (nm)	585	639	670	693	701
effective band gap (eV)	2.12	1.94	1.85	1.79	1.77
ΔE (eV)	0.38	0.20	0.11	0.05	0.03

| (b) CBD−CdSe	3 hours	5 hours	7 hours	9 hours
absorption onset (nm)	608	617	626	636
effective band gap (eV)	2.04	2.01	1.98	1.95
ΔE (eV)	0.30	0.26	0.23	0.20

3. The dependence of energy levels on QD size
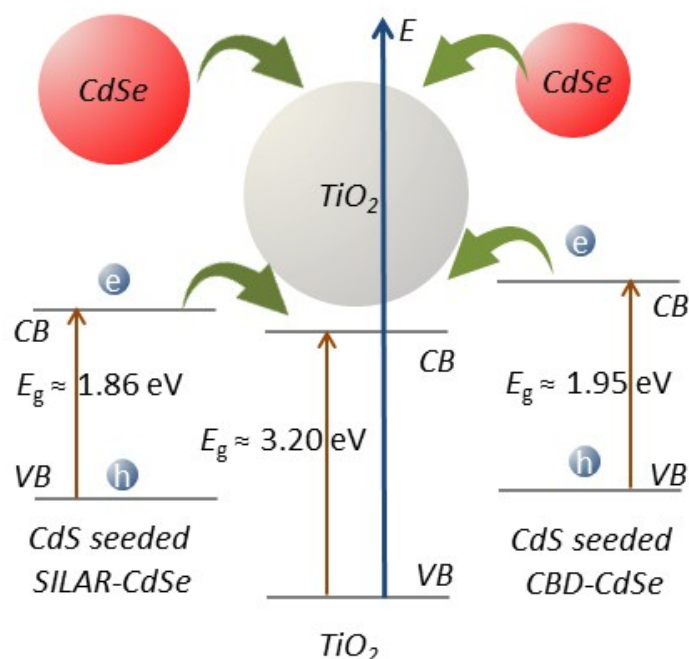
Scheme S2 Scheme illustrating the dependence of energy difference between the CB on the QD size for CdS seeded SILAR−CdSe and CBD−CdSe, and the electron transfer from the CdSe QDs with different sizes into TiO_2.

4. XPS measurements All XPS spectra were taken on a Surface Science Instruments S-probe spectrometer. Three spots were analyzed on each sample and analysis of the samples included a broad survey and detail spectra. The Service Physics Hawk Data Analysis Software was used to determine peak areas and calculate the elemental compositions from peak areas above an inelastic scattering (Shirley) background. S2s and S2p peaks located at the same binding energies with Se3s and Se3p peaks, and which required approximate calculation of S peak intensities by measuring the total area of the [S2s+ Se3s] peak envelope at ~230 eV, then subtracting from that the contribution from the Se3s peak as calculated from the Se3d peak scaled by the ratio

of the sensitivity factors (SF_{Se3s}/SF_{Se3d}). Surface compositions were calculated and the results were collected in Table S2. The corresponding atomic concentrations obtained from XPS analysis indicated that the amount of QDs loaded onto CdS/CBD−CdSe electrode was higher than that of CdS/ SILAR−CdSe one.
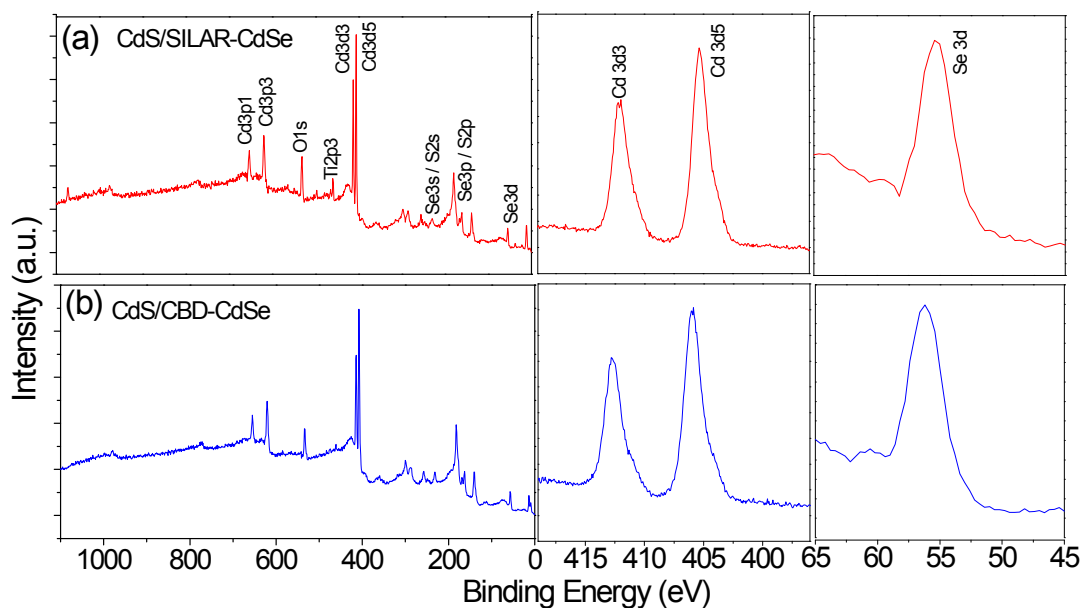
Fig. S2 Typical survey and detail spectra of XPS for (a) CdS/SILAR−CdSe and (b) CdS/CBD−CdSe sensitized TiO_2 films, respectively.

Table S2 Surface compositions (atomic concentration, %) of CdS/SILAR−CdSe and CdS/CBD−CdSe sensitized TiO_2 electrode obtained from XPS analysis based on the measurements of three spots

sample	O 1s	S 2s	Ti 2p	Se 3d	Cd 3d
CdS/SILAR−CdSe	39.4 (±3.1)	8.9 (±4.6)	7.3 (±1.1)	17.3 (±2.6)	27.0 (±1.4)
CdS/CBD−CdSe	33.3 (±4.1)	9.3 (±6.4)	4.2 (±1.9)	23.9 (±8.0)	29.2 (±4.7)