Electronic Supplementary Material (ESI) for RSC Advances.
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ELECTRONIC SUPPLEMENTARY INFORMATION

1. Optical characterization of QDs

The optical absorption and emission spectra of CdSe QDs of three different sizes (represented as 1, 2 and 3) dispersed in hexane are shown in Fig. S1 (a). The QDs sizes were estimated from the first excitonic absorption peak.[1] The corresponding band gap energies were calculated from the respective PL emission peaks wavelengths. The wavelengths, the QDs sizes and the energy gap values of the CdSe QDs are listed in Table S1. Fig. S1(b) shows absorption spectrum of PbS QDs dispersed in hexane. The optical bandgap of PbS QDs was determined from the absorption spectrum, which is about 1.3 eV.

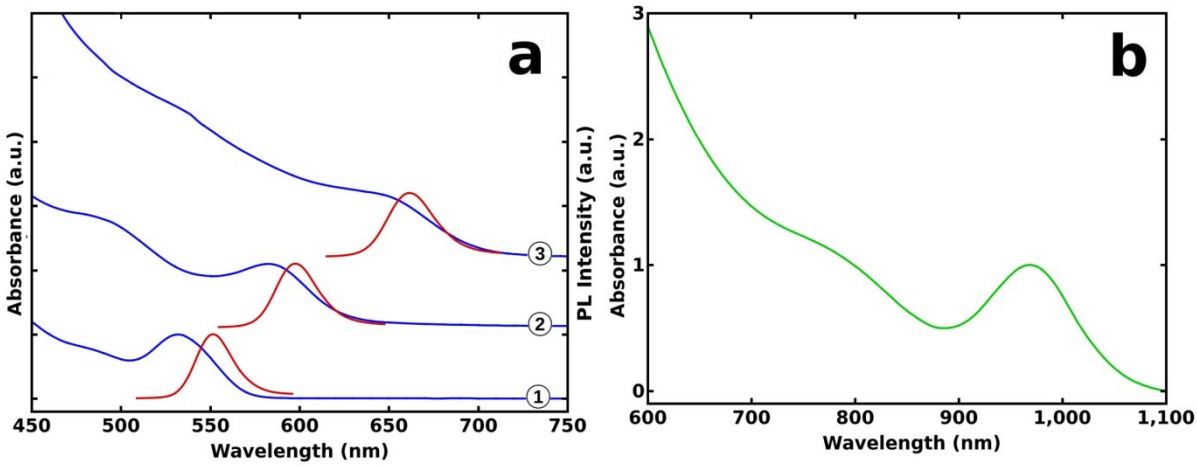

Fig. S1 (a) Absorption and emission spectra of CdSe QDs dispersed in hexane (b) Absorption spectrum of PbS QDs dispersed in hexane.

Table S 1. Absorption and emission peak values of CdSe QDs with their size and band gap.

No.	Absorption peak (nm)	CdSe QD size (nm)	Emission peak (nm)	Band gap (eV)
1	644	7	662	1.87
2	582	4	598	2.07
3	532	2.9	551	2.25

2. HRTEM studies of the QDs

Fig. S2 (a), (b) and (c) shows the high-resolution transmission electron microscopy (HRTEM) images of the CdSe QDs having average particle size 2.9 nm, 4 nm and 7 nm respectively. Fig. S2 (d) shows the HRTEM image of PbS QDs having a particle size of about 3 nm. The HRTEM images confirm the monodispersity and crystallinity of the QDs grown.

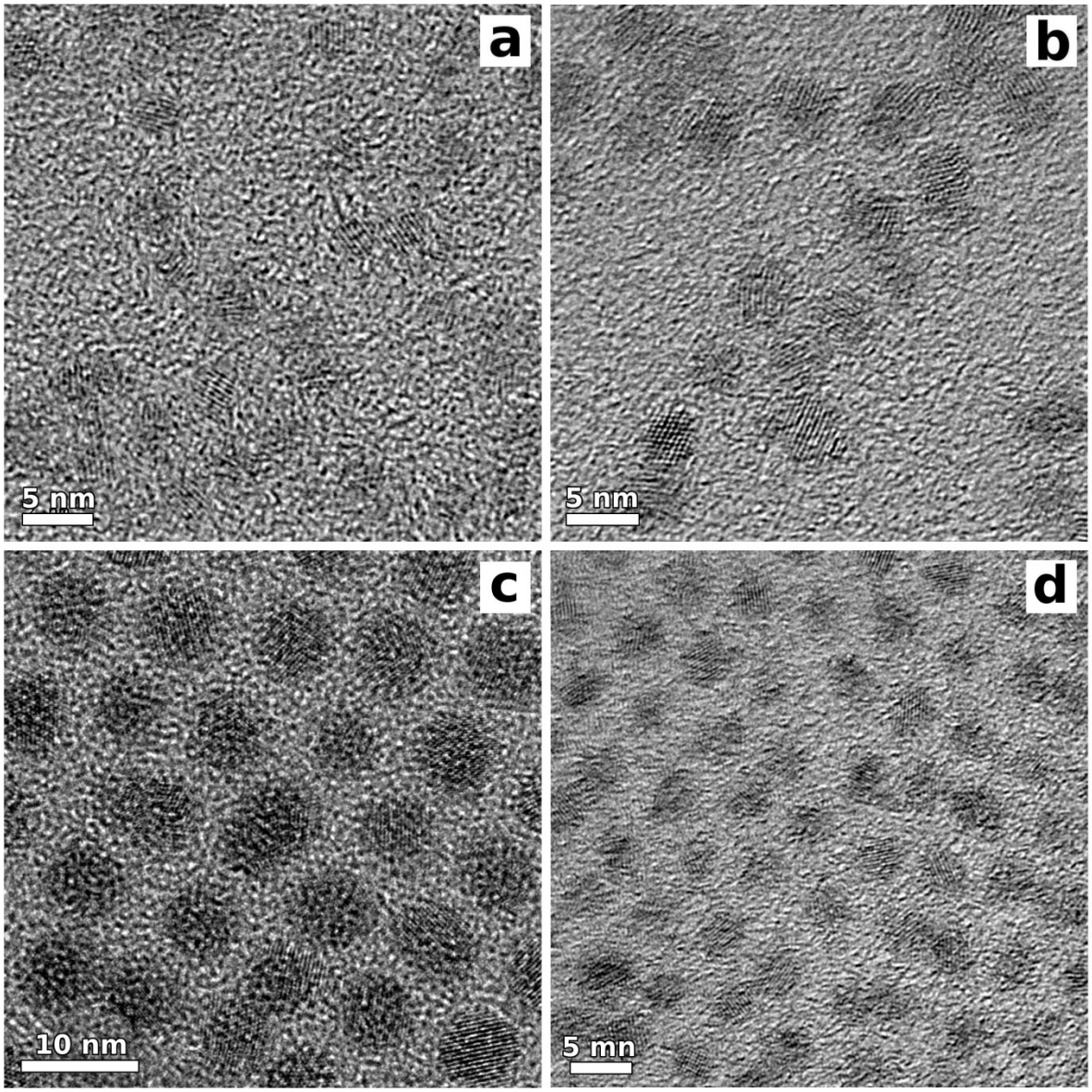

Fig. S2 HR-TEM images of (a) CdSe QDs of size 2.9 nm, (b) CdSe QDs of size 4 nm, (c) CdSe QDs of size 7 nm and (d) PbS QDs of size 3 nm.

3. FTIR studies of EDT and OA capped CdSe QDs layers on glass

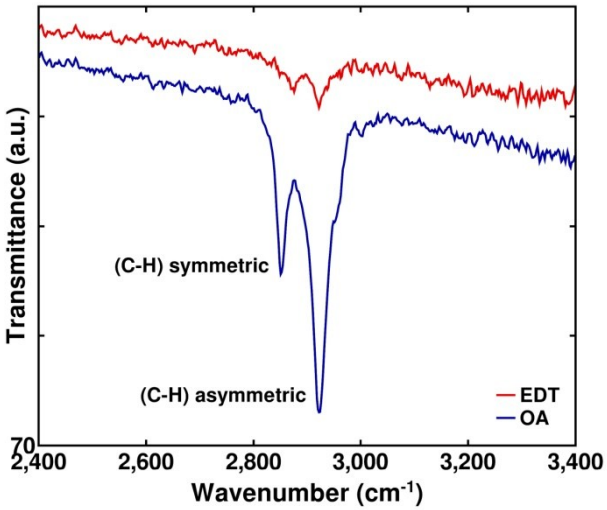

Fig. S3 FTIR spectra of OA and EDT capped CdSe layers on glass.

4. Ultraviolet Photoelectron Spectroscopy (UPS) studies of CdSe QDs layers

The HOMO and LUMO levels of the CdSe layer were obtained using ultraviolet photoelectron spectroscopy (UPS) and photoluminescence (PL) spectroscopy. Fig. S4 shows the UPS spectrum of CdSe QDs layer passivated by EDT ligand. The work function (- 4.74 eV) of the CdSe layer was determined from the intersection of the secondary electron cutoff (- 16.46 eV) occurring at the high binding energy. Similarly, the value of HOMO with respect to the work function was determined from the intersection (-1.40 eV) of the linear portion of the spectrum with the baseline at the low binding energy side, as shown in figure. The LUMO of the CdSe layer was found by adding the HOMO value to the band gap of the QDs (2.07 eV), calculated from the emission peak (Table S 1). Thus, the LUMO value calculated from both PL and UPS is - 4.07 eV (Table S2). The calculation procedure is described in detail by Jeon et al.[2]

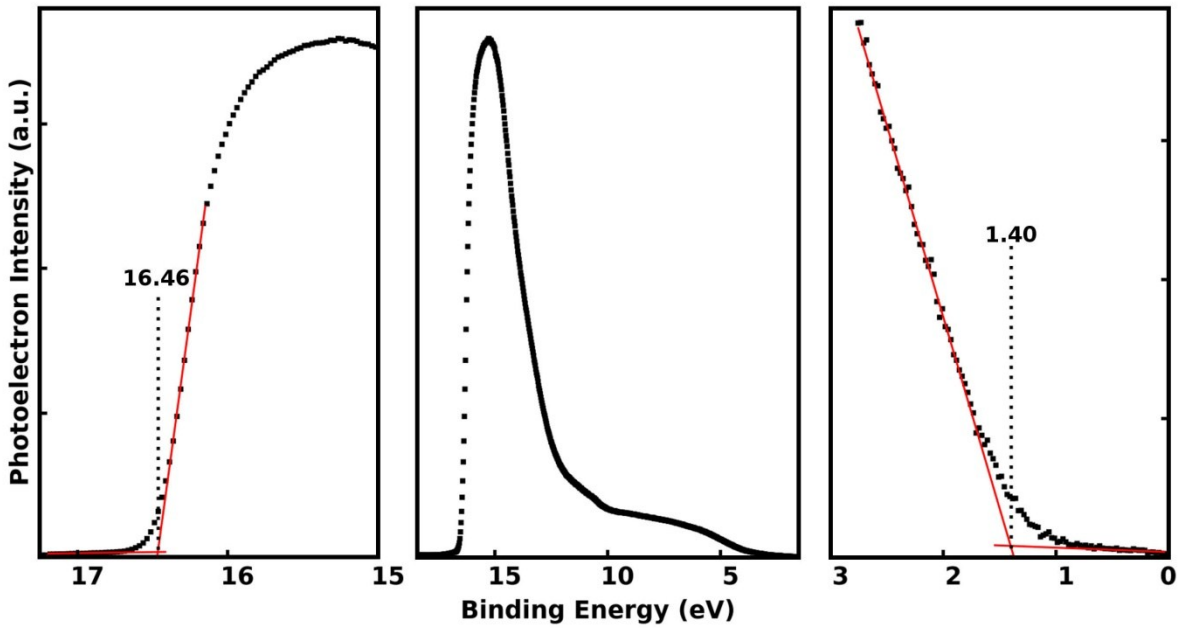

Fig. S4 UPS spectra of EDT passivated CdSe QDs layer. Left panel shows the secondary electron cut off region with cut off value listed, the centre panel shows the entire UPS spectrum and the right panel shows the magnified spectra near the Fermi edge with listed intersection value.

5. Active layer absorptances of the devices

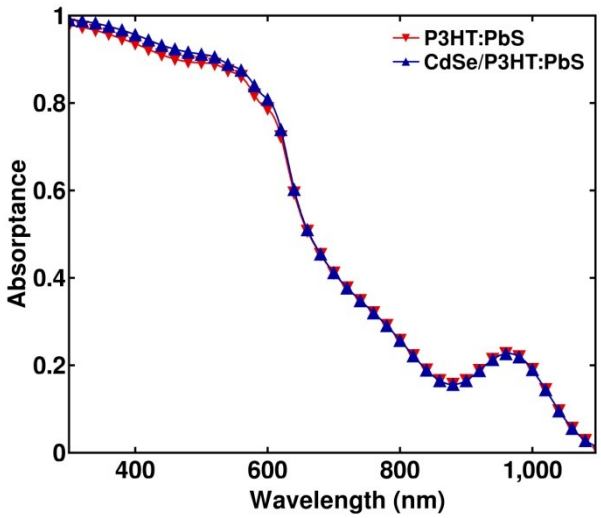

Fig. S5 Active layer absorptances of the devices with and without buffer layer.

6. Energy level positions of the constituent layers of the solar cell

Table S 2. HOMO and LUMO values of the constituent layers of the ITO/ZnO/CdSe/P3HT:PbS/Au hybrid solar cell.

Layers	LUMO	HOMO
ZnO[3,4,5]	4.2	7.5
PbS[6]	3.9	5.2
P3HT[5]	3.2	5.1
CdSe	4.07	6.14

REFERENCES

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