Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Supporting Information

Enhanced charge transport from Pd-doping in $CsPbBr_3$ quantum dots for efficient photoelectrocatalytic water splitting

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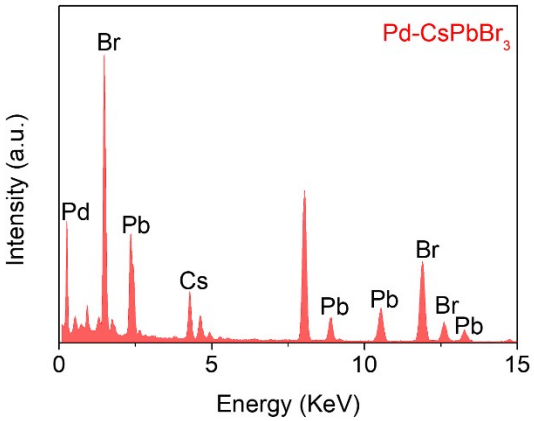

Figure S1 EDS of Pd-$CsPbBr_3$ QDs

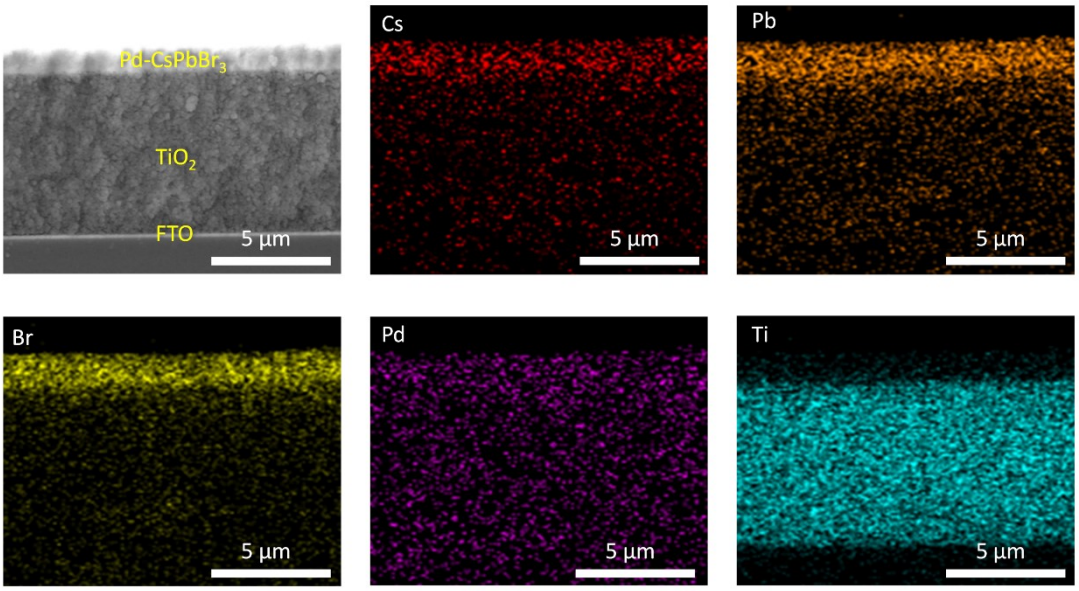

Figure S2. The cross-sectional SEM and EDS images of Pd-$CsPbBr_3$ QDs based device.

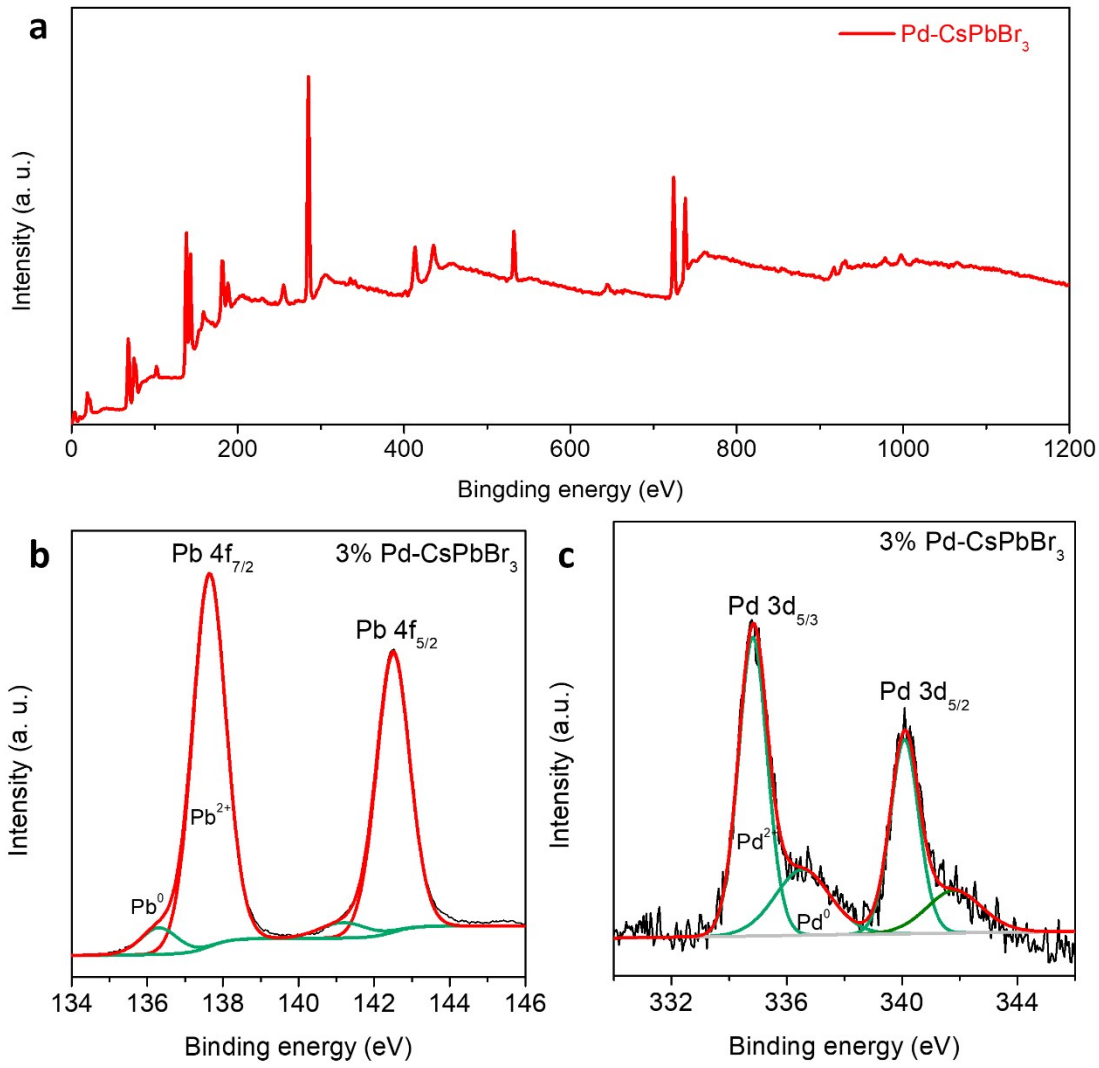

Figure S3. (a) The survey XPS spectrum of Pd-$CsPbBr_3$ QDs. The XPS (b) Pb 4f and Pd 3d spectrum of 3% Pd-$CsPbBr_3$ QDs.

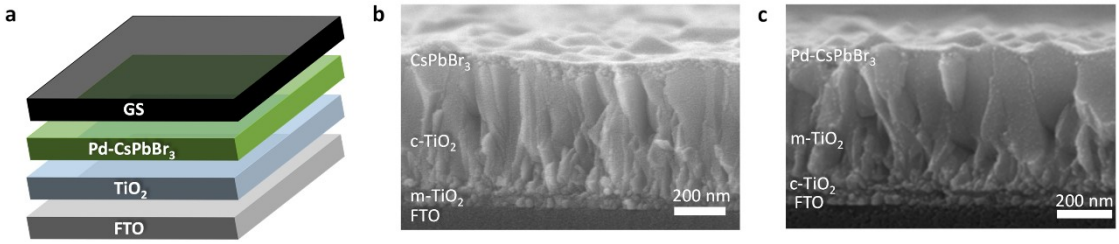

Figure S4. (a) The schematic of Pd-$CsPbBr_3$ QDs based device layer by layer. The cross-sectional EDS of the (b) $CsPbBr_3$ and (c) Pd-$CsPbBr_3$ QDs.

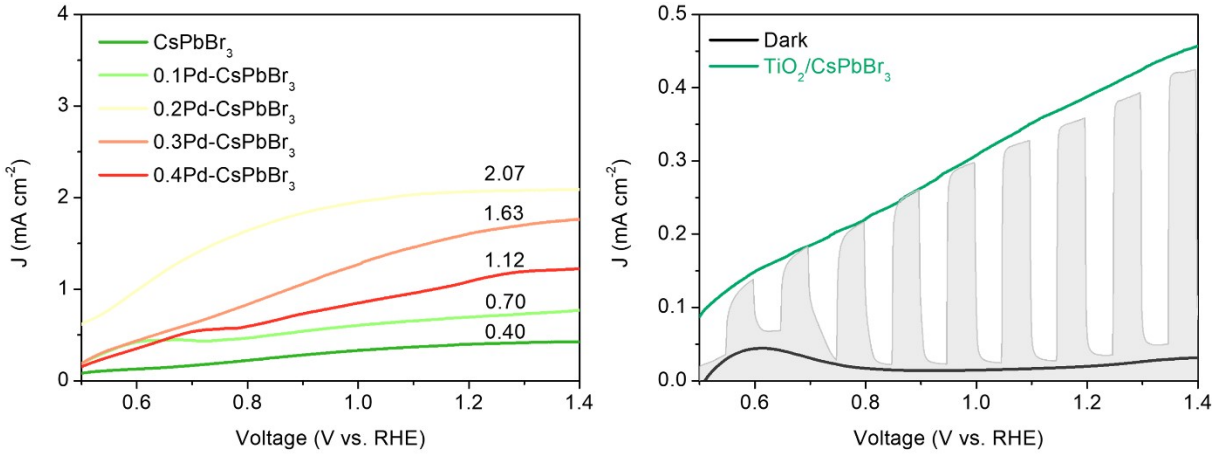

Figure S5. LSV of the Pd-$CsPbBr_3$ QDs based photoanode with different concentrations of Pd doping. The chopped plot of the $CsPbBr_3$ QDs based device.

Table S1. The cross-sectional element EDS mapping of Pd-$CsPbBr_3$ QDs based device.

Element	Weight percentage	Wt % Sigma
O	38.55	0.43
Ti	36.95	0.35
Pb	4.59	0.32
Br	12.89	0.20
Pd	2.60	0.22
Cs	4.42	0.35

Table S2. The Pd/Pb ratio versus dopant concentration of Pd-$CsPbBr_3$ QDs determined by ICP-OES.

Sample	Cx (ug/kg)	W (%)
Pd	19568723.0	0.2%
Cs	190178909.6	19.02%
Pb	285336133.0	28.53%
Br	84114215.4	8.41%

Table S3. High-resolution XPS peak positions of Cs, Br and Pb elements in $CsPbBr_3$ and Pd-$CsPbBr_3$ QDs.

Sample	Cs (eV)		Br (eV)		Pb (eV)	
	Cs $3d_{5/3}$	Cs $3d_{3/2}$	Br $3d_{5/3}$	Br $3d_{3/2}$	Pb $4f_{7/2}$	Pb $4f_{5/2}$
$CsPbBr_3$	722.0	735.9	66.2	67.3	136.4	141.3
Pd-$CsPbBr_3$	722.0	735.9	66.2	67.3	136.6	141.5

Table S4. The corresponding band energy parameters of Pd-$CsPbBr_3$ and Pd-$CsPbBr_3$ QDs.

Sample	E_{GB} (eV)	E_F(eV)	E_{VB}(eV)	E_{CB}(eV)
$CsPbBr_3$	2.35	-3.95	-5.95	-3.6
Pd-$CsPbBr_3$	2.30	-4.02	-5.79	-3.49

Table S5. Fitted parameters of TRPL decay curves in perovskite films with using Pd-$CsPbBr_3$ and Pd-$CsPbBr_3$ QDs.

ETLs	A_1	τ_1 [ns]	A_2	τ_2 [ns]	τ [ns]
$CsPbBr_3$	486.90	5.26	1304.30	0.91	3.87
Pd-$CsPbBr_3$	899.99	2.28	396.35	13.38	10.28

The TRPL decay was fitted by a bi-exponential decay function with below equation:

$$PL_{\text{int}ensity} = A_1 e^{\frac{-t}{\tau_1}} + A_2 e^{\frac{-t}{\tau_2}}$$

where A_1 and A_2 are time-independent coefficients of amplitude fraction for each decay component, τ_1 and τ_2 are decay time of a fast and slow component, respectively.