Electronic Supporting Information

Surface Passivation by Congeneric Quantum Dots for High-Performance and Stable $CsPbBr_3$-Based Photodetectors

Shikai Yan, [a] Sheng Tang, [a] Manman Luo,[a] Lu Xue,[a] Shilin Liu,[a] Elias Emeka Elemike,[b] Byung Seong Bae,[c] Javed Akram,[d] Jing Chen,[a] Zhiwei Zhao,[a] Zhuoya Zhu,[a] Xiaobing Zhang,[a] Wei Lei*[a] and Qing Li*[a]

[a] *Joint International Research Laboratory of Information Display and Visualization, School of Electronic Science and Engineering, Southeast University, Nanjing, Jiangsu, P. R. China*

[b] *Chemistry Department, North-West University, South Africa*

[c] *Department of Electronics &Display Engineering, Hoseo University, Hoseo Ro 79, Asan city, Chungnam 31499, Korea*

[d] *Department of Physics, COMSATS University Islamabad, Islamabad 45550, Pakistan*

E-mail: lw@seu.edu.cn; liqing@seu.edu.cn

Contents

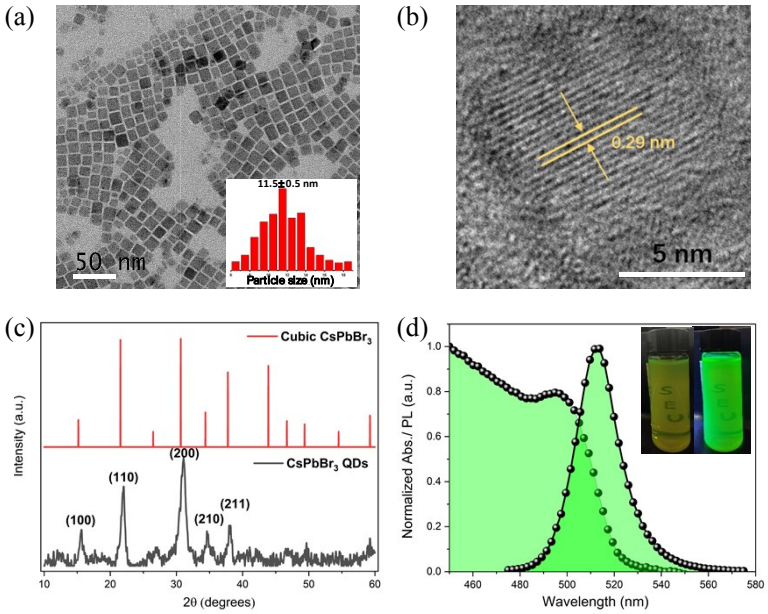

Figure S1. (a) TEM and (b) HRTEM images of $CsPbBr_3$ QDs. (c) XRD pattern of $CsPbBr_3$ QDs. (d) UV-vis absorption and PL spectra of the prepared $CsPbBr_3$ QDs in 1-octane. The inset shows the pictures of $CsPbBr_3$ QDs in the ambient air and UV light.

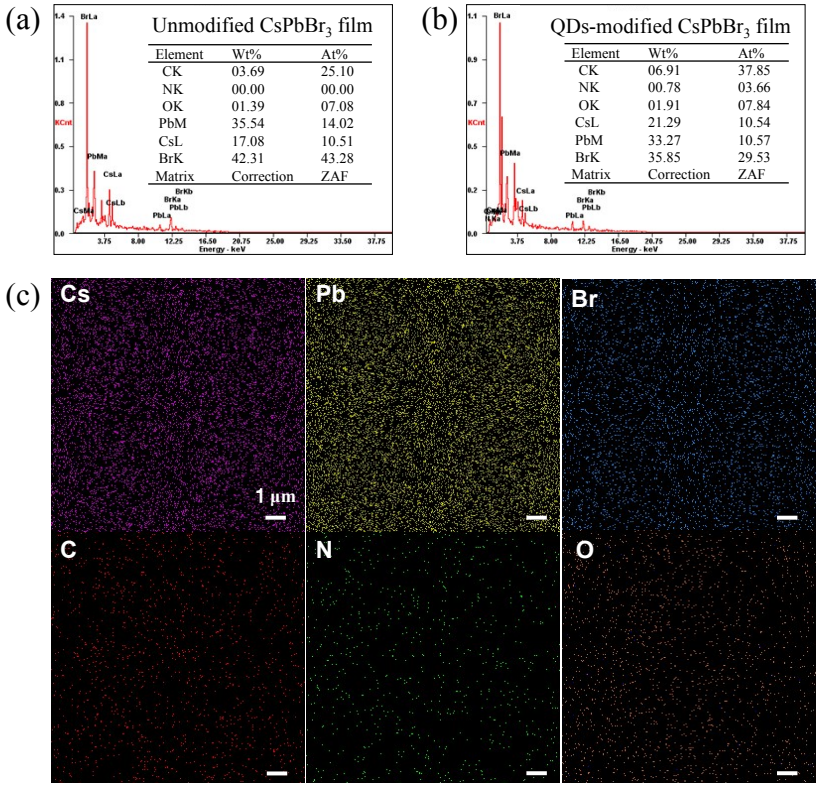

Figure S2. (a, b) EDX measurement of $CsPbBr_3$ films without and with QDs on the surface. (c) EDX mapping of QDs-modified CsPbBr3 film.

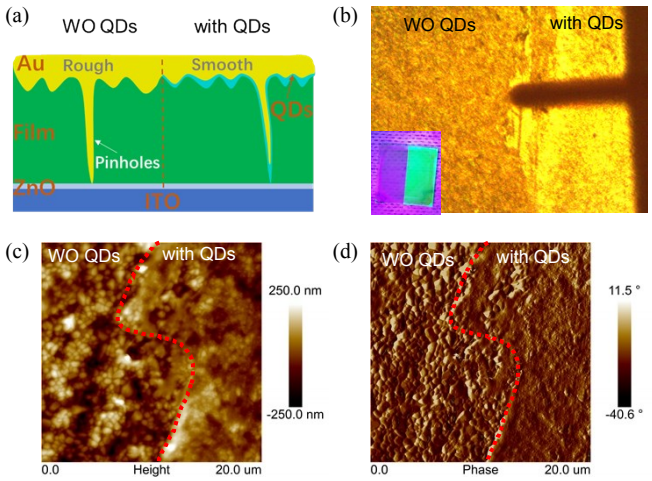

Figure S3. (a) Illustration depicting the function of CsPbBr3 QDs as buffer layer in PDs. (b) Optical microscope image and camera picture (inset) of the as-prepared sample, half of which is covered by QDs. (c) AFM height and (d) phase patterns of $CsPbBr_3$ films WO and with $CsPbBr_3$ QDs on the surface.

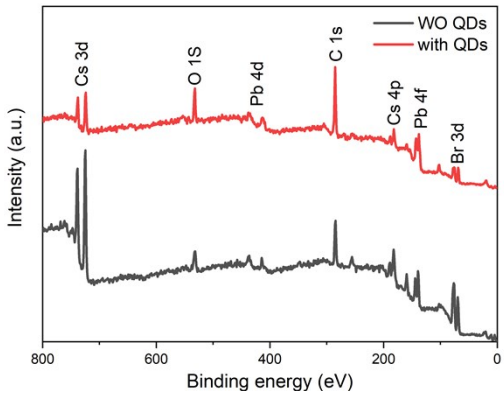

Figure S4. XPS spectra of $CsPbBr_3$ films WO and with $CsPbBr_3$ QDs.

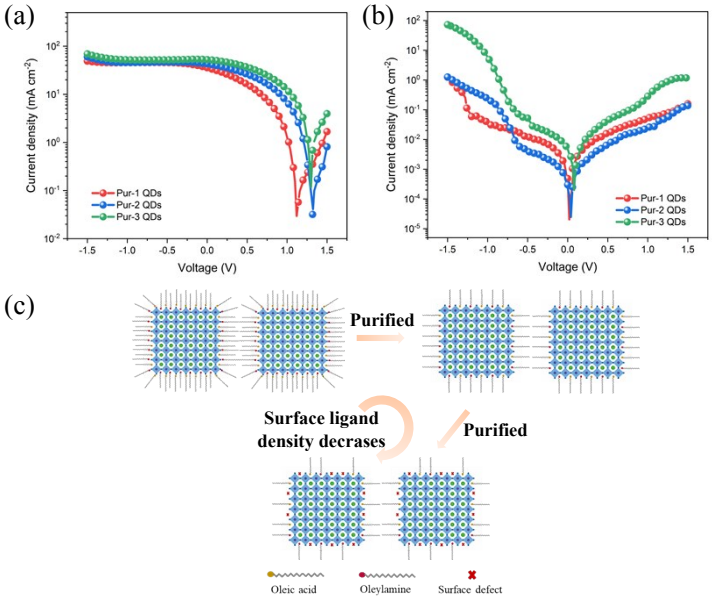

Figure S5. Current density–voltage (J–V) curves of the PDs using QDs with one to three purification cycles under (a) 409 nm light with intensity of 100 mW cm^{-2} and (b) dark condition. (c) Schematic diagram of the change of ligands densities and surface defects densities

after different purification cycles.

Table S1. The VBM and CBM values of $CsPbBr_3$ film without and with QDs

Sample	VBM (eV)	CBM (eV)
Unmodified $CsPbBr_3$ film	5.61	3.25
QDs-modified $CsPbBr_3$ film	5.58	3.22

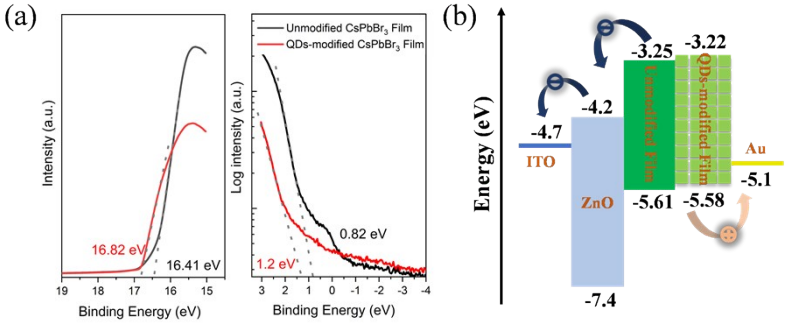

Figure S6. (a) UPS spectra of the unmodified perovskite films and QDs-modified $CsPbBr_3$ films. (b) Energy-level diagram of the materials used in the PDs.

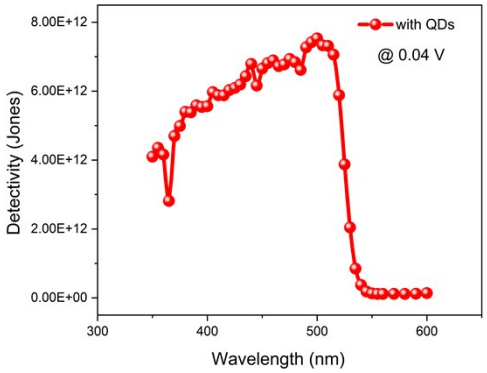

Figure S7. Responsivity and detectivity curves of the QDs-modified PDs as a function of light wavelength at 0.04 V.

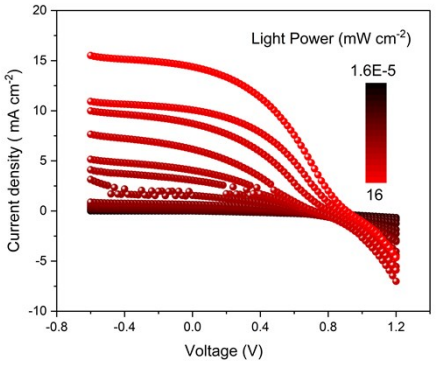

Figure S8. I-V curves of QDs-modified PDs under 409 nm light illumination with different luminous densities.

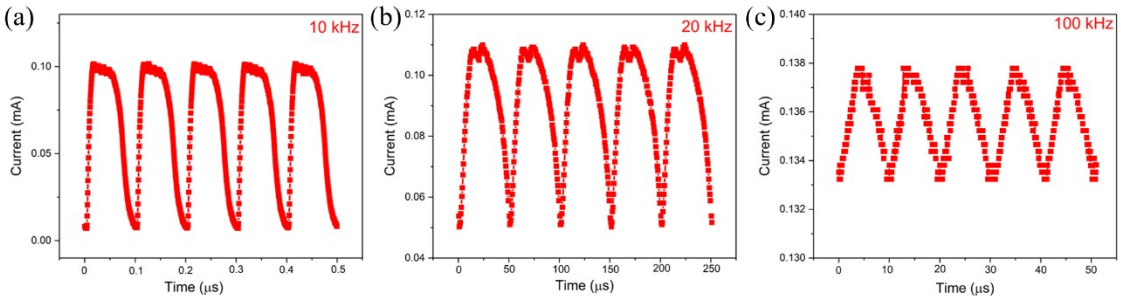

Figure S9. Photoresponse characteristics of the QDs-modified PDs to pulsed light irradiation at frequencies of (a) 10 KHz, (b) 20 KHz, (c) 100 kHz under a voltage of 0 V.

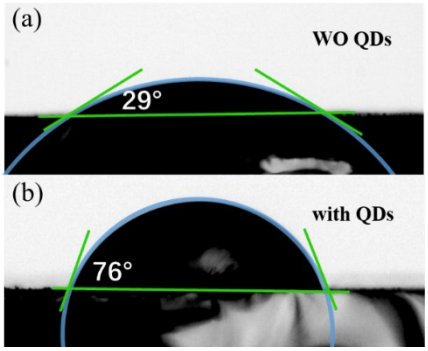

Figure S10. Water contact angle on the $CsPbBr_3$ films (a) WO and (d) with QDs.

Table S2. Fitting parameters extracted from EIS test.

Device	R_s (Ω)	R_{tr} (Ω)	R_{rec} (Ω)
WO QDs	13.7	1323	3282
with QDs	4.5	1926	52320