Supporting Information

Bandgap Tunable $Cs_x(CH_3NH_3)_{1-x}PbI_3$ Perovskite Nanowires by Aqueous Solution Synthesis for Optoelectronic Devices

Dongdong Dong[+], Hui Deng[+], Chao Hu, Huaibing Song, Keke Qiao, Xiaokun Yang, Jian Zhang, Fensha Cai, Jiang Tang , Haisheng Song[*]

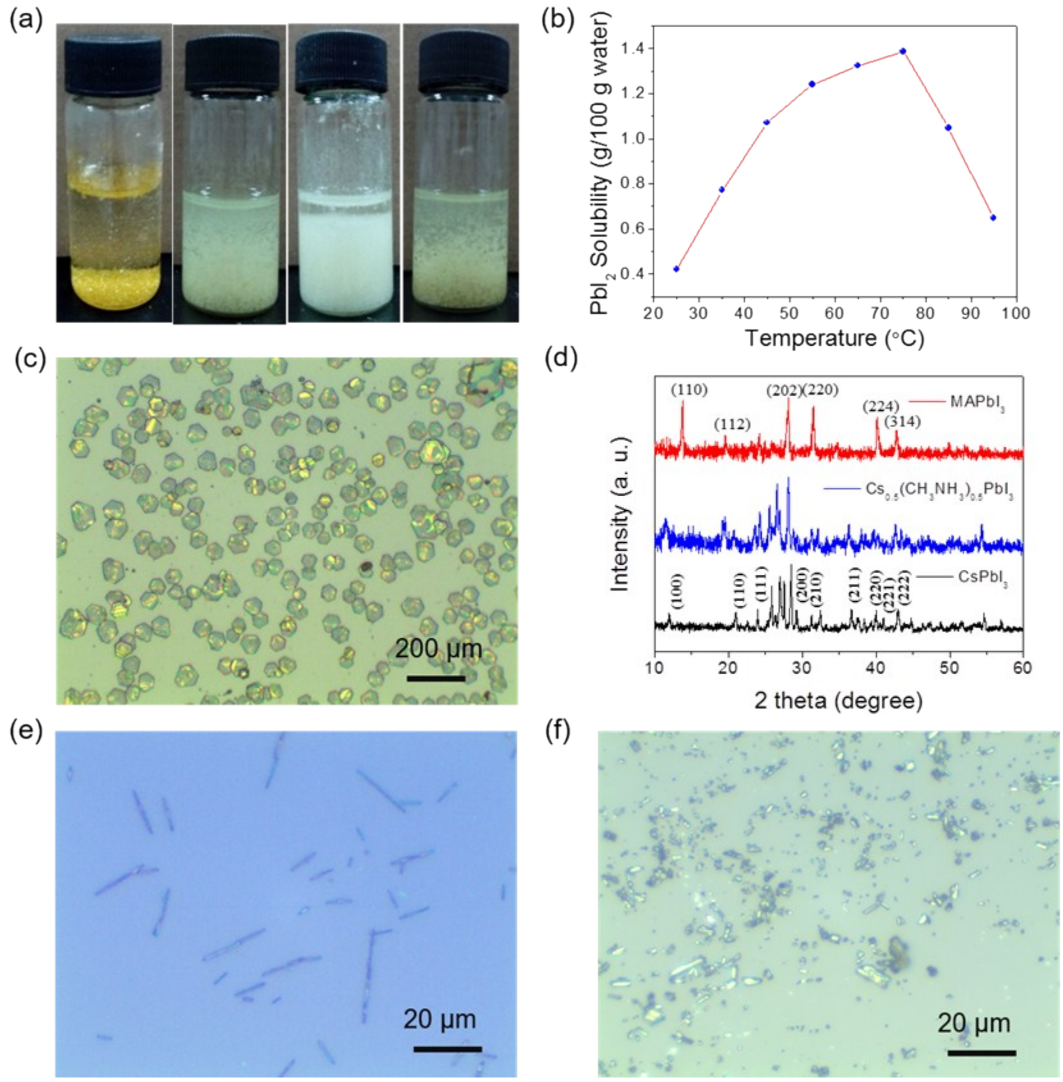

Figure S1. (a) The successively photographs of PbI_2, $CsPbI_3$, $CH_3NH_3PbI_3$ and $Cs_{0.5}(CH_3NH_3)_{0.5}PbI_3$ in aqueous solution. (b) Solubility of PbI_2 in aqueous solution evolved with temperature. (c) Optic microscope graph of PbI_2 nanoflake separated out from PbI_2 saturated solution by temperature reduction. (d) XRD spectra of $CH_3NH_3PbI_3$, $Cs_{0.5}(CH_3NH_3)_{0.5}PbI_3$ and CsPbI3 perovskite NWs. (e) pure NWs obtained from 2D PbI_2 precursor. (f) Nanorods and particles from PbI_2 powder precursor.

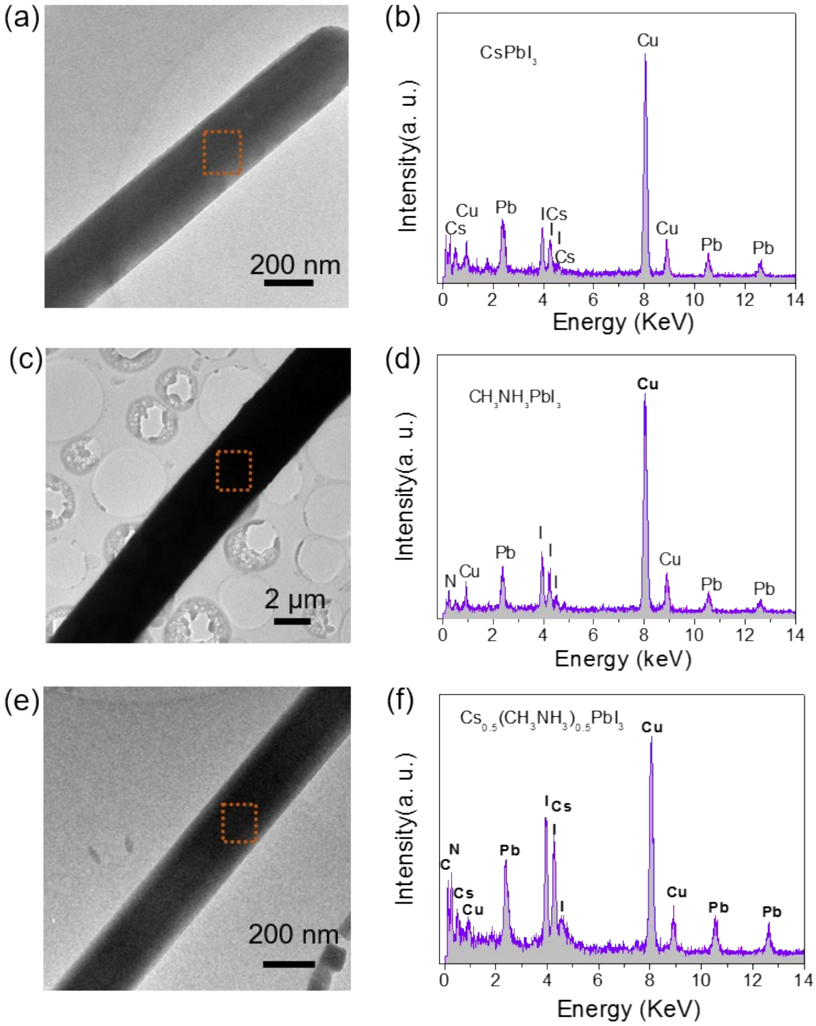

Figure S2. (a, c, e) the TEM graphs of $CsPbI_3$ NW (a), $CH_3NH_3PbI_3$ NW (c) and $Cs_x(CH_3NH_3)_{1-x}PbI_3$ NW (e). (b, d, f) the EDS spectra of pure $CsPbI_3$ NW (b), $CH_3NH_3PbI_3$ NW (d) and $Cs_{0.5}(CH_3NH_3)_{0.5}PbI_3$ NW (f) from selected areas.

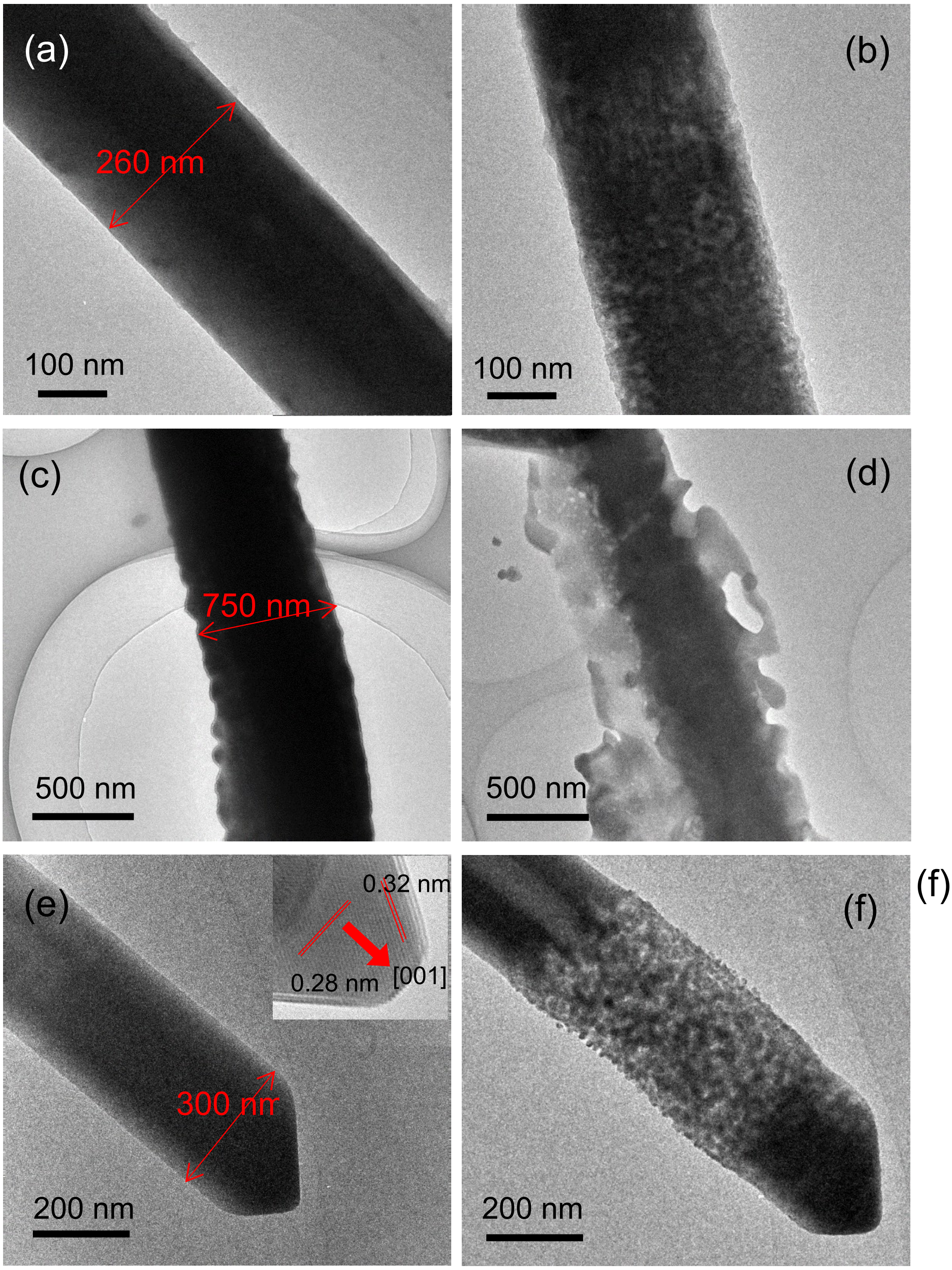

Figure S3. Electron beam illumination stability of three kinds of perovskite NWs: $CsPbI_3$ (a, b), $CH_3NH_3PbI_3$ (c, d) and $Cs_{0.5}(CH_3NH_3)_{0.5}PbI_3$ (e, f). The electron beam irradiation demonstrates the improved stability by Cs^+ introduction.

Table S1 Performance summary of perovskite nanowire photodetector.

Device structure	**Responsivity (A/W)**	**EQE (%)**	**Rise/Decay time**	**Year**	**Ref**
Au/$CH_3NH_3PbI_3$ mcrowire/Au	13.5	-	80 μs/240 us	2016	1
ITO/ $CsPbBr_3$ nanosheet/ITO	0.25	53	19 μs/ 25μs	2016	2
Au/$CH_3NH_3PbI_3$ nanowire/Au	5×10^{-3}	-	-	2016	3
Au/$CH_3NH_3PbI_3$ single crystal/Au	2.24	36.16	71 μs/112 μs	2016	4
Au/$CH_3NH_3PbI_3$ network/Au	0.1	-	300 μs/400 μs	2015	6
Au/$CH_3NH_3PbI_3$ nanowire/Au	1.32	-	200 μs/300 μs	2015	5
Au/porous $CH_3NH_3PbBr_3$ nanowires/Au	-	-	120 ms/86 ms	2015	7
Au/ single $Cs_{0.5}(CH_3NH_3)_{0.5}PbI_3$ nanowire/Au	23	5.4×10^3	10 ms/20 ms	-	This work

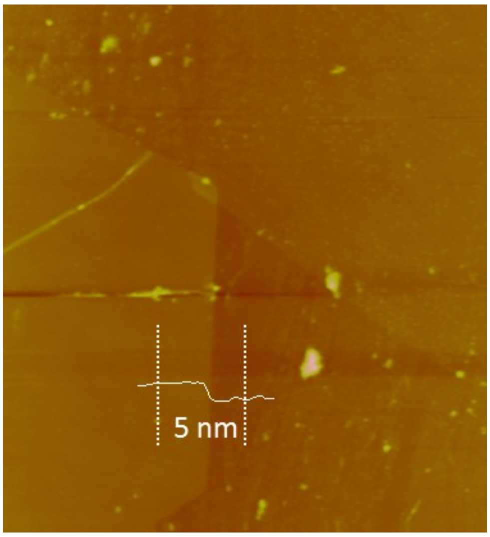

Fig. S4 One typical AFM (Atomic Force Scanning Microscope) image of PbI_2 flake. The thickness is ~5 nm.

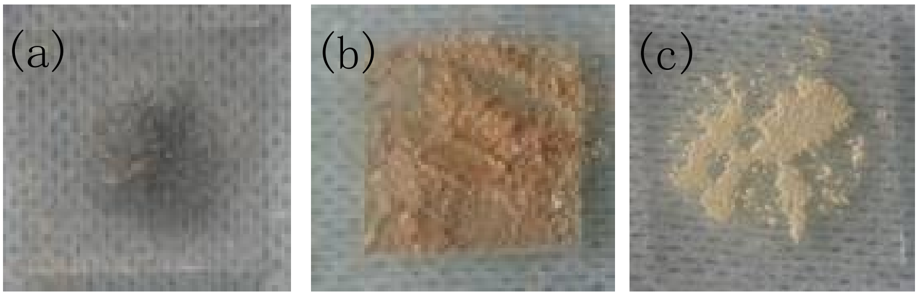

Fig. S5 Optical images of perovskite nanowires: (a) $CH_3NH_3PbI_3$ nanowire; (b) $Cs_{0.5}(CH_3NH_3)_{0.5}PbI_3$ nanowire; (c) CsPbI3 nanowires.

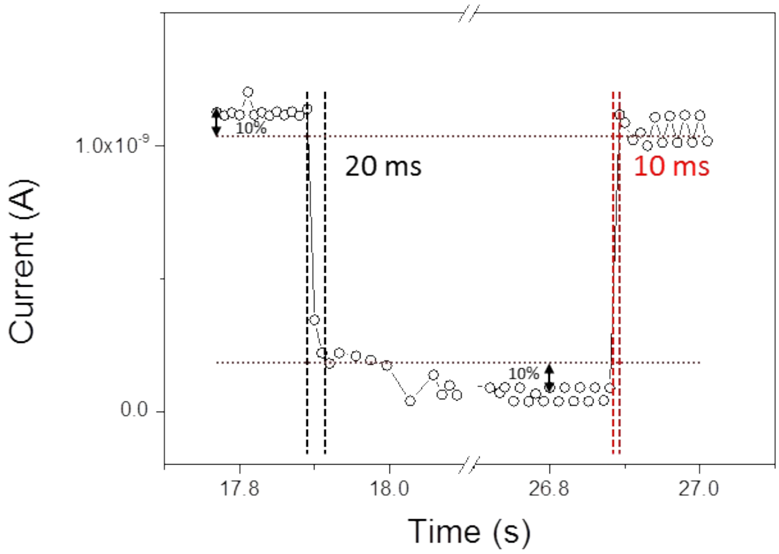

Fig. S6 The rise and decay time of photodetectors.

Reference

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