

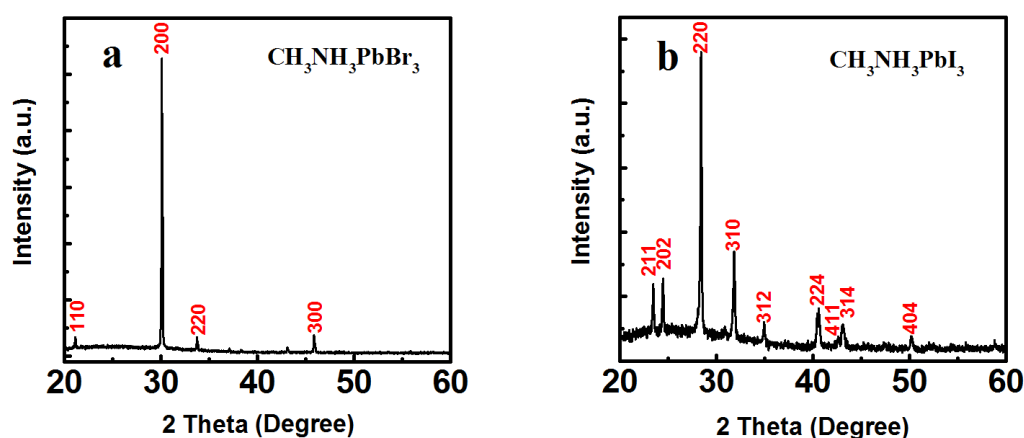
Electronic Supplementary Information

## High Performance Hybrid Solar Cells Sensitized by Organolead Halide Perovskites

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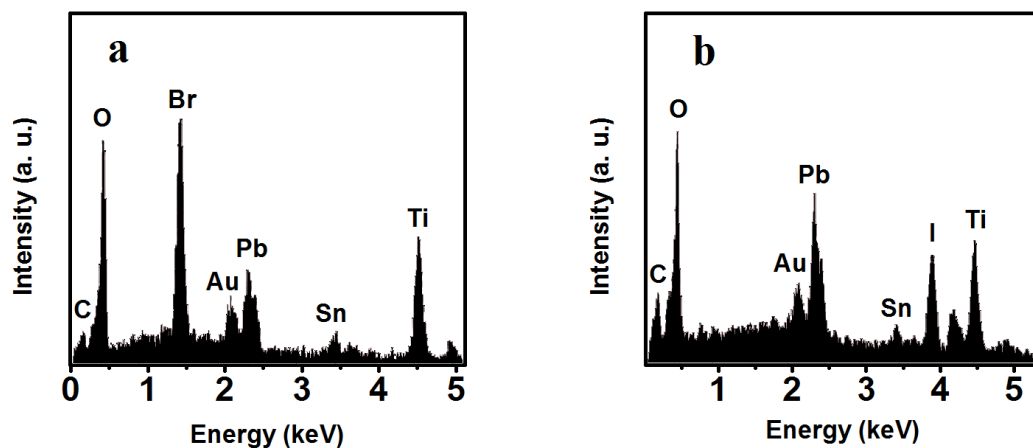
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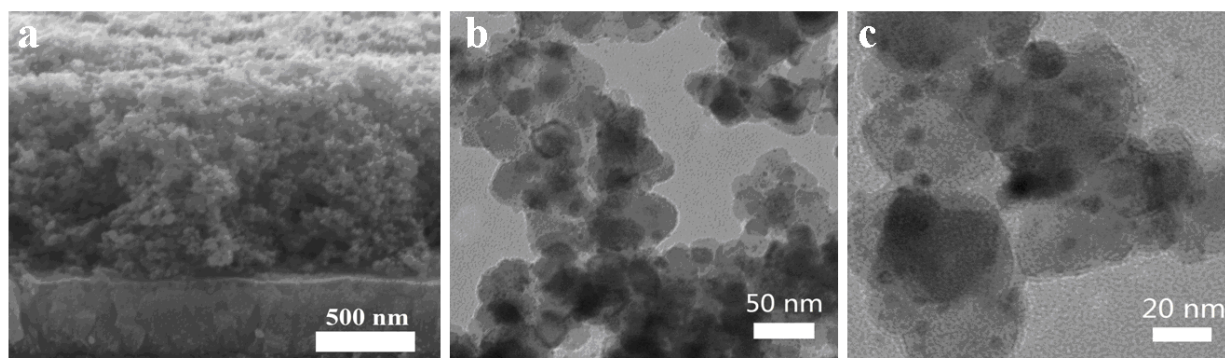


**Fig. S1** X-ray diffraction (XRD) of (a)  $\text{CH}_3\text{NH}_3\text{PbBr}_3$  and (b)  $\text{CH}_3\text{NH}_3\text{PbI}_3$  deposited on slide glass by spin coating and then annealed at 100°C for 15min.

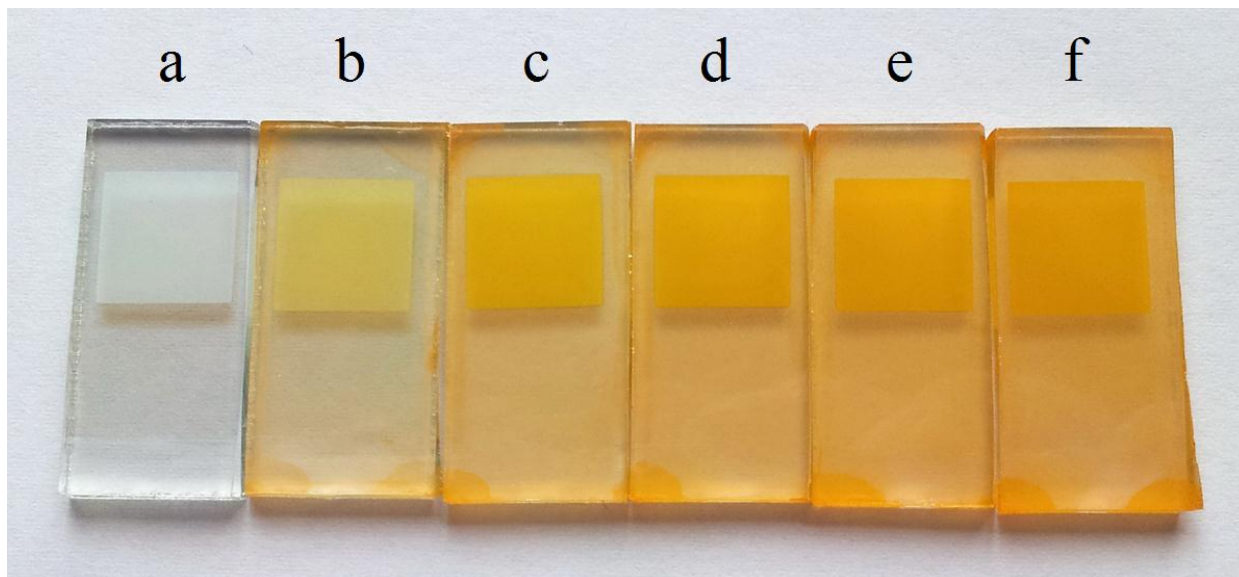
X-ray diffraction results are in accordance with those in the related references,<sup>1,2</sup> which showed that both the materials synthesized have the perovskite crystalline structures.



**Fig. S2** Energy-dispersive X-ray (EDX) spectroscopy of photovoltaic devices: (a) FTO/TiO<sub>2</sub>/CH<sub>3</sub>NH<sub>3</sub>PbBr<sub>3</sub>/PCBTDP and (b) FTO/TiO<sub>2</sub>/CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub>/PCBTDP. Small amount of Au was sprayed on the surface to improve the electrical conductivity of SEM samples.



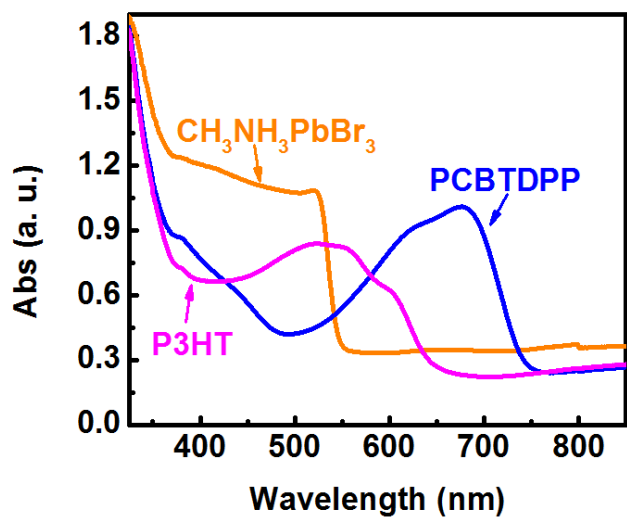
**Fig. S3** (a) SEM image of the cross-section of FTO/TiO<sub>2</sub>/CH<sub>3</sub>NH<sub>3</sub>PbBr<sub>3</sub>/PCBTDP device. (b), (c) TEM images of the TiO<sub>2</sub> particles with CH<sub>3</sub>NH<sub>3</sub>PbBr<sub>3</sub> nanoparticles deposited on the surface.



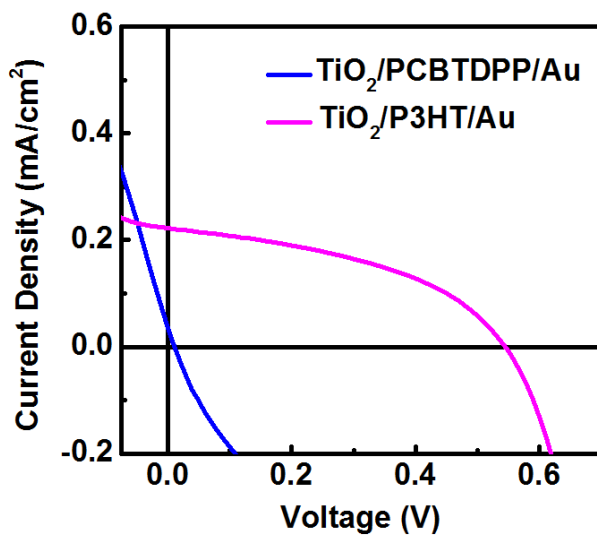
**Fig. S4** Photo images of the FTO/TiO<sub>2</sub>/CH<sub>3</sub>NH<sub>3</sub>PbBr<sub>3</sub> samples with the precursor concentrations of (a) 0.0M, (b) 0.1M, (c) 0.2M, (d) 0.3M, (e) 0.4M, and (f) 0.5M, respectively.

**Table S1** Photovoltaic parameters of the hybrid solar cell devices TiO<sub>2</sub>/PCBDTPP/Au and TiO<sub>2</sub>/P3HT/Au, both of which are without the perovskite sensitizer.

Solar cells	J <sub>sc</sub> (mA/cm <sup>2</sup> )	V <sub>oc</sub> (V)	FF	η (%)
TiO <sub>2</sub> /PCBDTPP/Au	0.036	0.01	0.06	0.00
TiO <sub>2</sub> /P3HT/Au	0.221	0.54	0.44	0.05



**Fig. S5** UV-Vis absorption spectra for the  $\text{TiO}_2/\text{CH}_3\text{NH}_3\text{PbBr}_3$ ,  $\text{TiO}_2/\text{PCBTDPP}$  and  $\text{TiO}_2/\text{P3HT}$ , respectively.



**Fig. S6** Current-voltage (J-V) curves for the device of the  $\text{TiO}_2/\text{PCBTDPP}/\text{Au}$  and  $\text{TiO}_2/\text{P3HT}/\text{Au}$ , and the photovoltaic parameters are given in Table S1.

**Table S2** Photovoltaic parameters of the hybrid solar cell of the TiO<sub>2</sub>/CH<sub>3</sub>NH<sub>3</sub>PbI<sub>3</sub>/Spiro-MeOTAD/Au subject to the storage at room temperature in the dark.

Time (h)	J <sub>sc</sub> (mA/cm <sup>2</sup> )	V <sub>oc</sub> (V)	FF	η (%)
4	17.35	0.86	0.43	6.48
30	16.23	0.86	0.36	5.01
71	11.96	0.80	0.35	3.34

**References:**

- 1 A. Kojima, K. Teshima, Y. Shirai, and T. Miyasaka, *J. Am. Chem. Soc.*, 2009, **131**, 6050.
- 2 J.-H. Im, C.-R. Lee, J.-W. Lee, S.-W. Park, and N.-G. Park, *Nanoscale*, 2011, **3**, 4088.