Supporting Information

Investigation of High Performance TiO_2 Nanorod Array Perovskite Solar Cells

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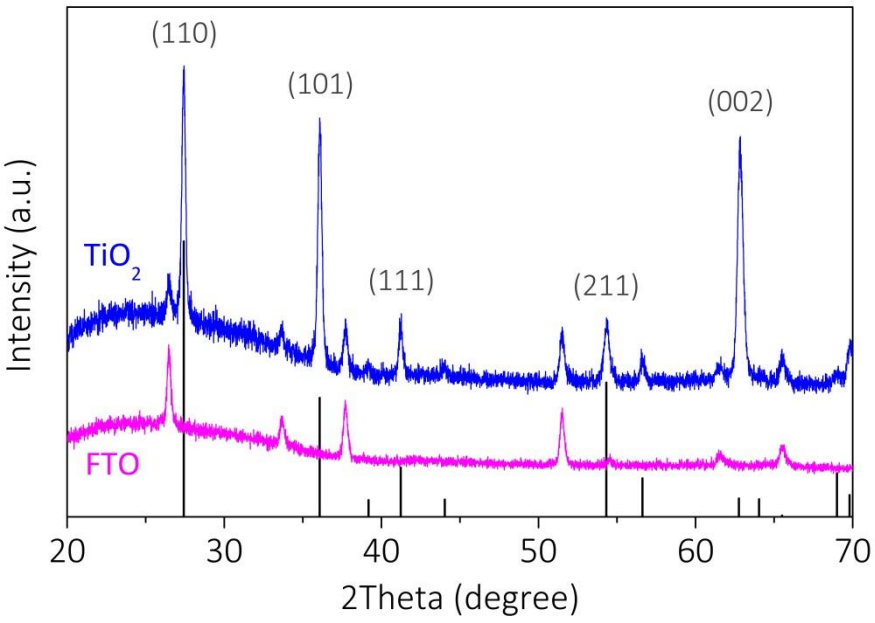

Figure S1. XRD patterns of FTO and TiO_2-NA synthesized by solvothermal reaction at 180 ^oC for 120 min. The vertical lines show the XRD pattern of rutile TiO_2 (JCPDS 86-0147).

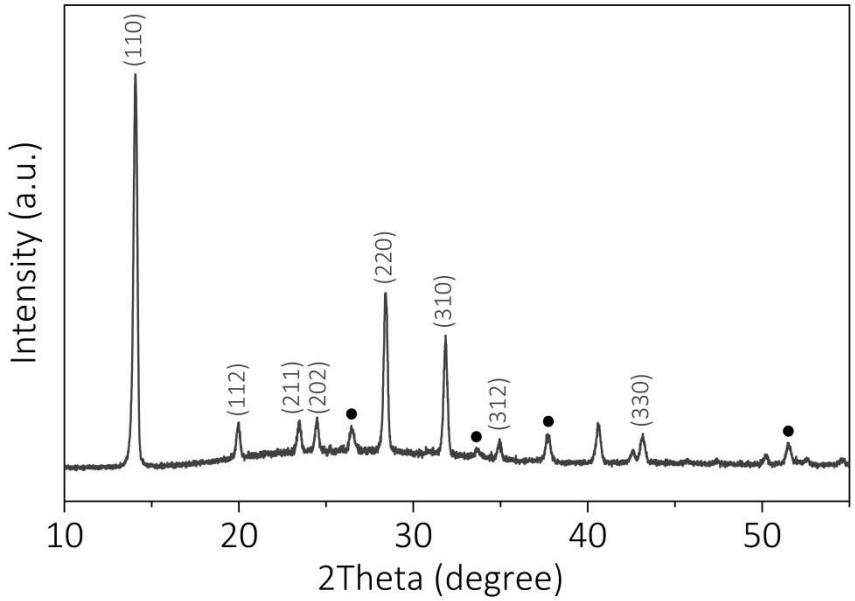

Figure S2. XRD pattern of TiO_2-P0 sample. The symbol "●" identifies the diffraction peaks of FTO, and the indices of crystal face are assigned to crystal planes of $CH_3NH_3PbI_3$.

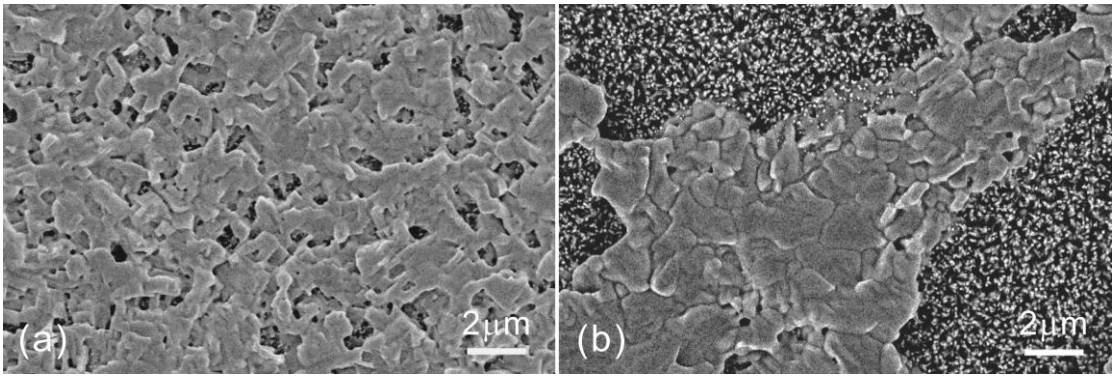

Figure S3. SEM images of TiO_2-NA/perovskite samples by using precursor with the molar ratio MACl/MAI = 1.5, (a) without DMSO in the precursor but with toluene dripping, and (b) with DMSO in the precursor but without toluene dripping.

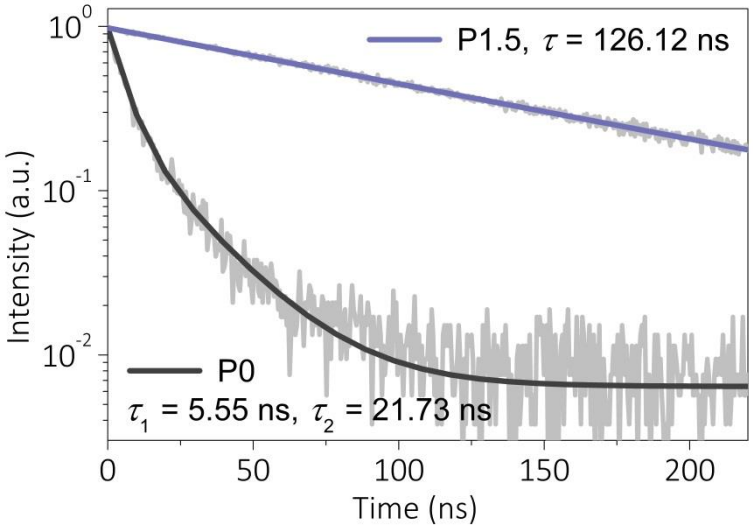

Figure S4. The results of TRPL for the sample P0 and P1.5.

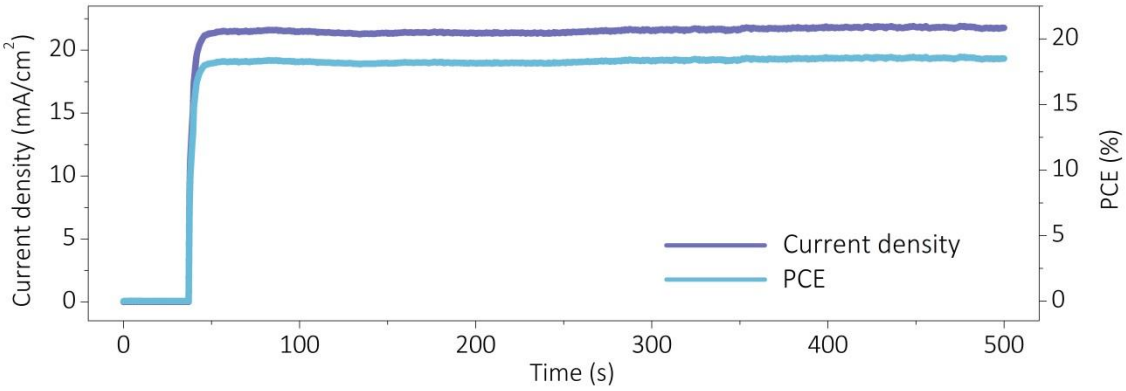

Figure S5. Photocurrent density and PCE as a function of time for a typical TiO_2-P1.5 device biased at 0.85 V under AM 1.5G illumination (100 mW/cm^2).

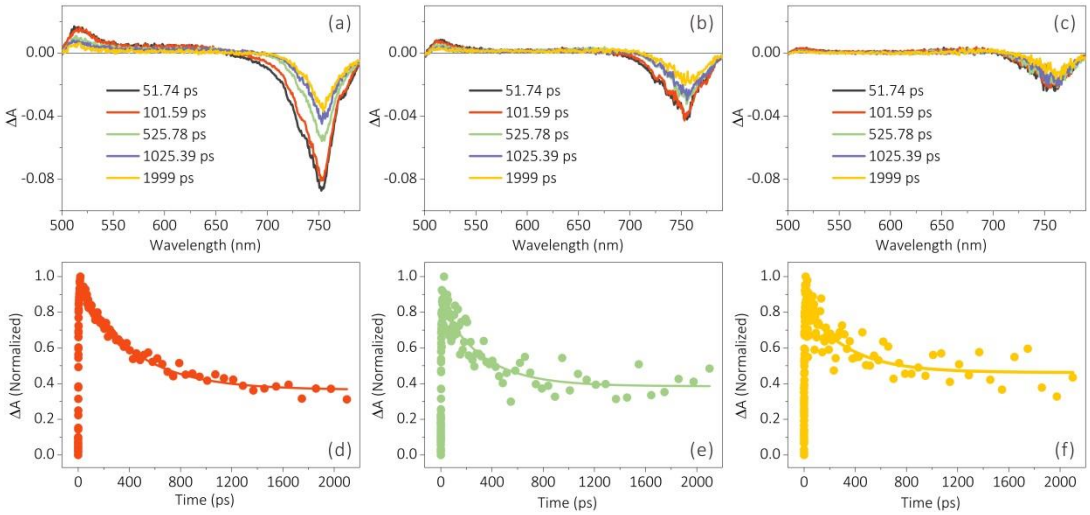

Figure S6. (a, b, c) fs-TA spectra and (d, e, f) corresponding band edge transition kinetics of (a, d) TiO_2-P0.5, (b, e) TiO_2-P1, and (c, f) TiO_2-P2 samples.

Table S1. Summary of the fitted parameters.

	A_1	τ_1 (ps)	A_2	$^*\tau_2$ (ps)
TiO_2-P0	0.39	813	0.35	92
TiO_2-P0.5	0.60	420	N/A	N/A
TiO_2-P1	0.46	324	N/A	N/A
TiO_2-P1.5	0.51	317	N/A	N/A
TiO_2-P2	0.38	336	N/A	N/A
CL-P1.5	0.61	436	N/A	N/A

*It may contain the artifact due to strong fluorescence scattering in the sample[1,2]

References

1. B. Giovani, M. Byrdin, M. Ahmad and K. Brettel, *Nat. Struct. Mol. Biol.* **2003**, *10*, 489.
2. K. Pydzińska, J. Karolczak, I. Kosta, R. Tena Zaera, A. Todinova, J. Idígoras, J. A. Anta and M. Ziółek, *ChemSusChem* **2016**, *9*, 1647.