Supporting Information

Low-temperature SnO_2-based electron selective contact for efficient and stable perovskite solar cells

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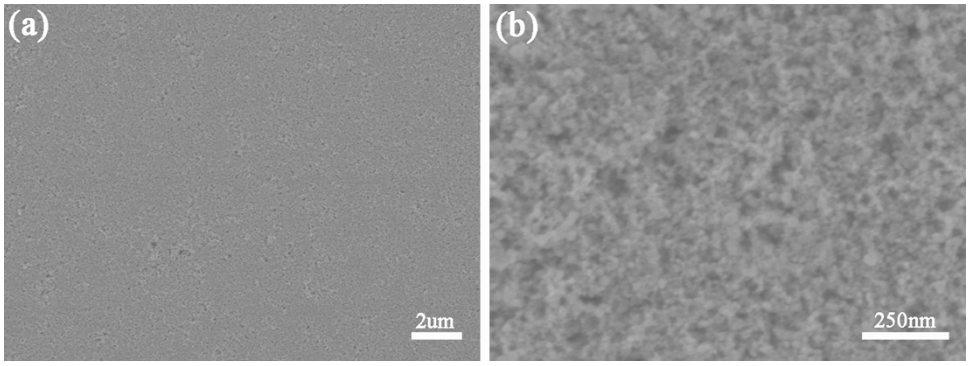

Figure S1. The low and high magnification SEM micrographs of ITO/SnO_2 film. (a) low magnification (b) high magnification

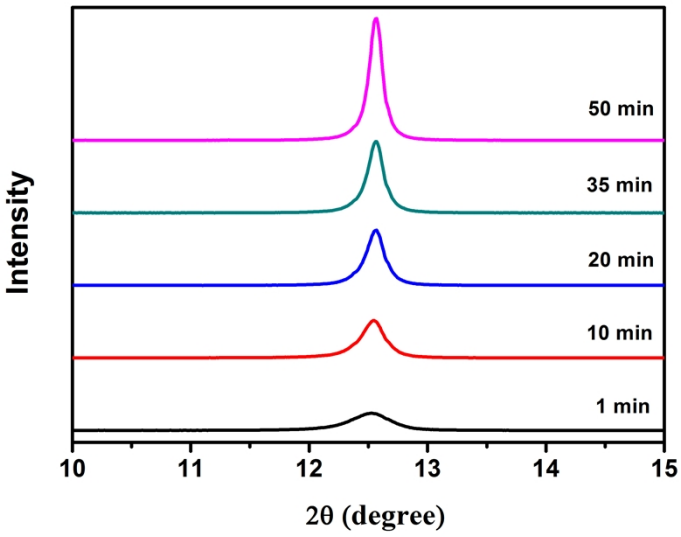

Figure S2. The enlarged X-ray diffraction patterns of ITO/SnO_2/PbI_2 films at 2θ =12.56° with different SVA time for PbI_2 layers.

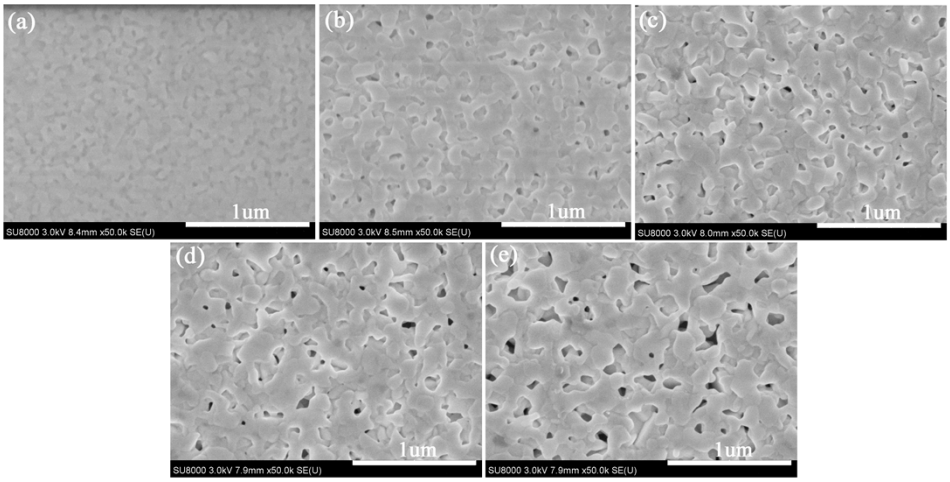

Figure S3. Low magnification SEM micrographs of ITO/SnO_2/PbI_2 thin films for different SVA times (a) 1min, (b) 10 min, (c) 20 min, (d) 35 min, and (e) 50 min.

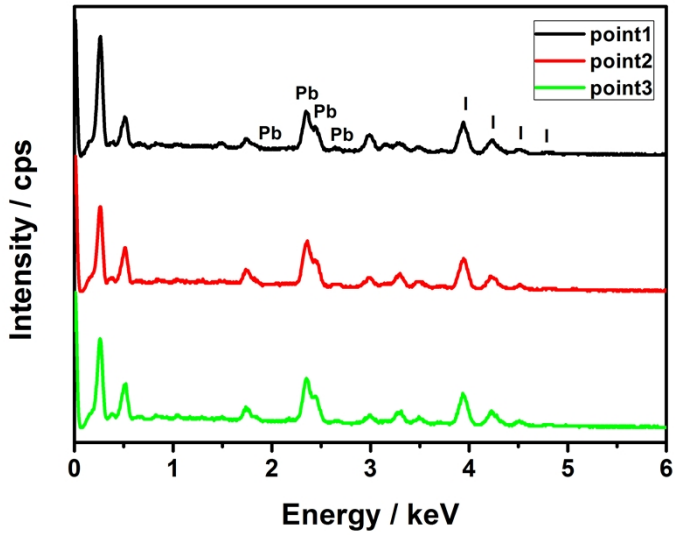

Figure S4. The EDX patterns for the perovskite layer obtained from the PbI_2 with 10 min SVA time.

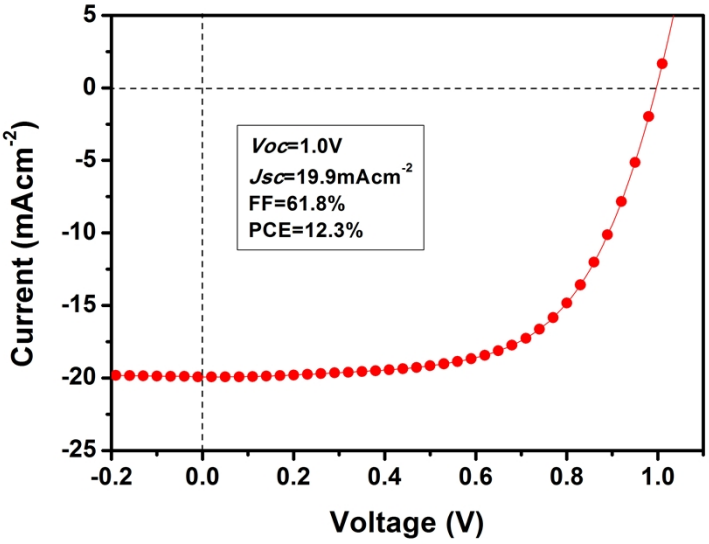

Figure S5. *J-V* characteristic for the FTO/TiO_2/$CH_3NH_3PbI_3$/spiro-OMeTAD/Ag device measured under 100 $mWcm^{-2}$ AM 1.5G illumination.

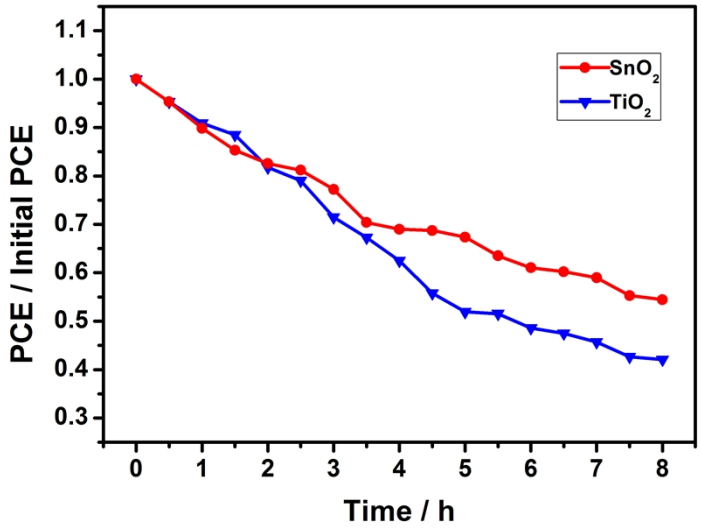

Figure S6. Illumination durability of the SnO_2-based and TiO_2-based PSC devices under simulated sunlight illumination.

TiO_2-based solar cell fabrication

The pre-patterned FTO substrates were cleaned with detergent, deionized water, acetone, and 2-propanol in sequence. The compact TiO_2 thin films were prepared according to the literature procedures.[1] All of the other procedures for the fabrication of TiO_2-based solar cells were same with that of the SnO_2-based solar cells.

Notes and references

1 H.-S. Kim, C.-R. Lee, J.-H. Im, K.-B. Lee, T. Moehl, A. Marchioro, S.-J. Moon, R. Humphry-Baker, J.-H. Yum, J. E. Moser, M. Grätzel and N.-G. Park, *Sci. Rep.* 2012, **2**, 591/1-591/7.