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Supporting Information

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Integrating Perovskite Solar Cells into a Flexible Fiber**

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Supporting Information

1 Experimental Section

(1) Synthesis of spinnable carbon nanotube array

Carbon nanotube (CNT) array was synthesized by chemical vapor deposition, and the synthetic details had been reported previously (*Acta Chim. Sinica* **2012**, *70,* 1523). The aligned CNT sheet was then drawn from the CNT array and wound onto the fiber substrate (*Adv. Mater.* **2014**, *26*, 2643). A post-treatment by isopropanol was used to achieve a close attachment of the CNT sheet on the fiber substrate.

(2) Synthesis of $CH_3NH_3PbI_3$

To synthesize $CH_3NH_3PbI_3$, a hydroiodic acid/water solution (45 wt%, 12.5 mL) was firstly added to a methylamine/ethanol solution (6.4 wt%, 124 mL), followed by reaction at room temperature for 2 h. The resulting solution was evaporated at 50 ℃ to produce a white powder of methylamine iodide. The methylamine iodide was then dissolved in ethanol and precipitated by diethyl ether. The product was further dried under vacuum and mixed with PbI_2 (99%) in γ–butyrolactone at 60 ℃ overnight to obtain $CH_3NH_3PbI_3$.

(3) Synthesis of Titanium diisopropoxide bis (acetylacetonate) and compact TiO_2 layer

Titanium diisopropoxide bis (acetylacetonate) was synthesized by mixing titanium (IV) isopropoxide and acetylacetone with a molar ratio of 1/2 in an ice bath. The n-type compact TiO_2 layer had been then produced by dip-coating a diluted titanium diisopropoxide bis(acetylacetonate)/ethanol solution (0.3 M), followed by pyrolysis at a temperature of 400 ^oC.

(4) Characterization

The structures were characterized by SEM (Hitachi FE-SEM S-4800 operated at 1 kV). X-ray diffraction patterns were obtained from an X-ray powder diffractometer

(D8 ADVANCE and DAVINCI.DESIGN). The absorbance spectra were recorded from an UV-Vis Spectrophotometer (Shimadzu, UV-2550). J-V curves were produced by a Keithley 2400 Source Meter under illumination (100 mW/cm^2) of simulated AM1.5 solar light coming from a solar simulator (Oriel-Sol3A 94023A equipped with a 450 W Xe lamp and an AM1.5 filter). The light intensity was calibrated using a reference Si solar cell (Oriel-91150). The effective area was calculated by multiplying the diameter of the coated steel wire and length of the fiber-shaped solar cell.

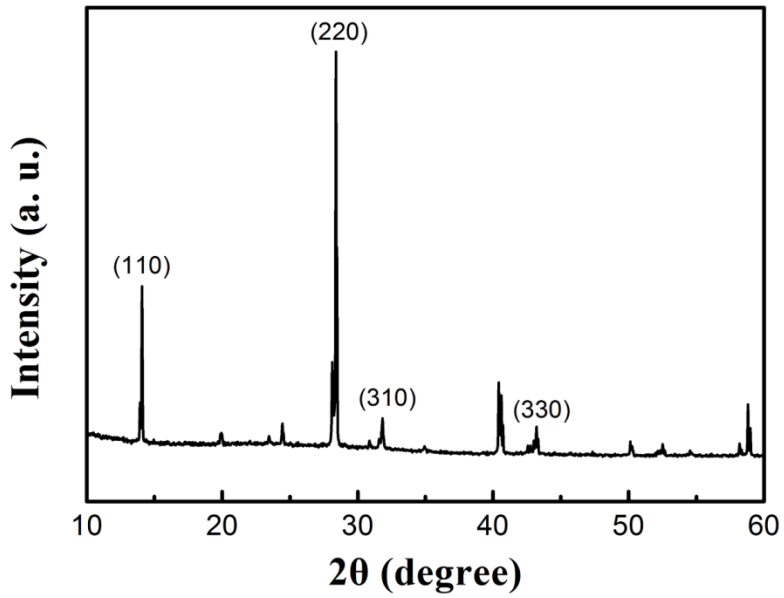

Figure S1. X-ray diffraction pattern of $CH_3NH_3PbI_3$ layer.

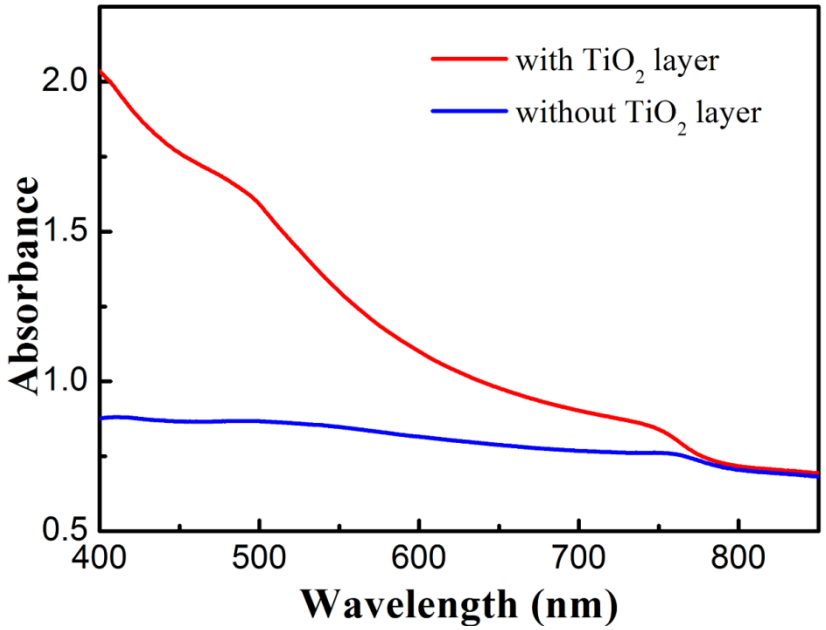

Figure S2. UV-vis absorption spectra of $CH_3NH_3PbI_3$ layer without and with the mesoporous TiO_2 layer.

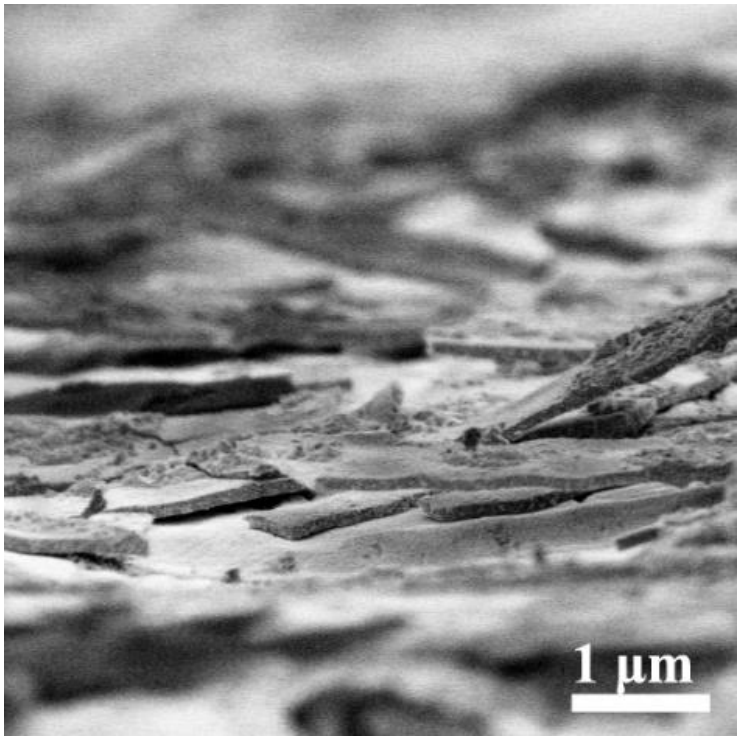

Figure S3. SEM image of a broken compact TiO_2 layer.

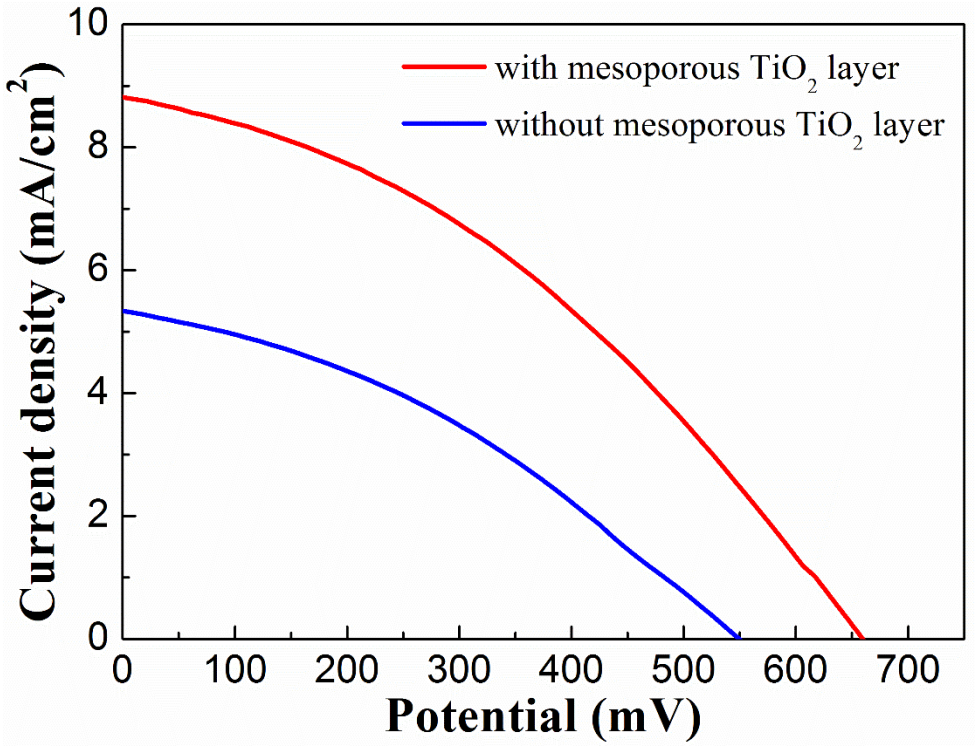

Figure S4. Typical J-V curves of fiber-shaped perovskite solar cells without and with the mesoporous TiO_2 layer.

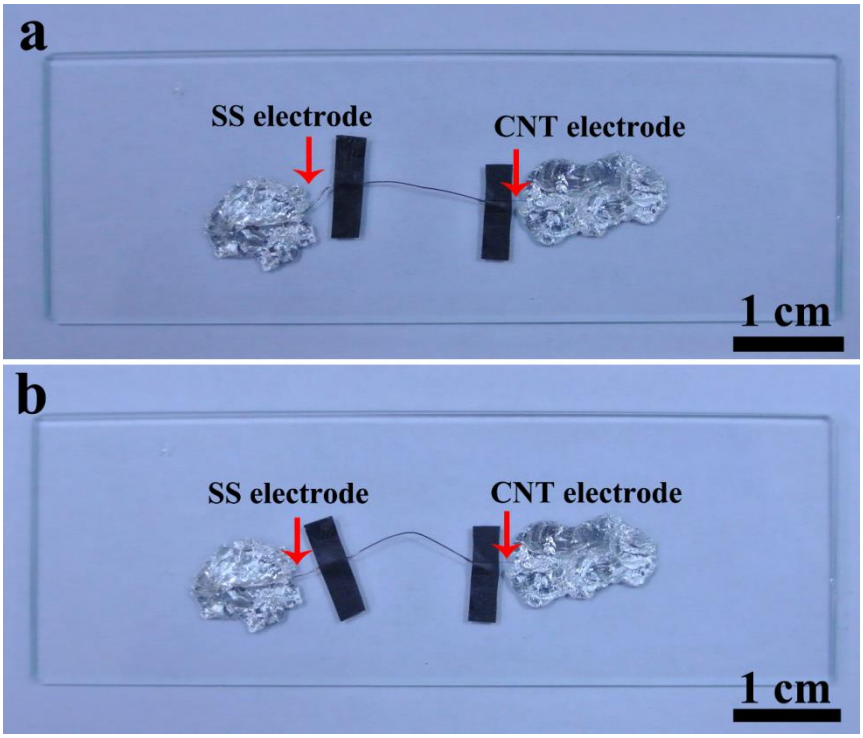

Figure S5. Photographs of a fiber-shaped perovskite solar cell before (**a**) and after bending (**b**).

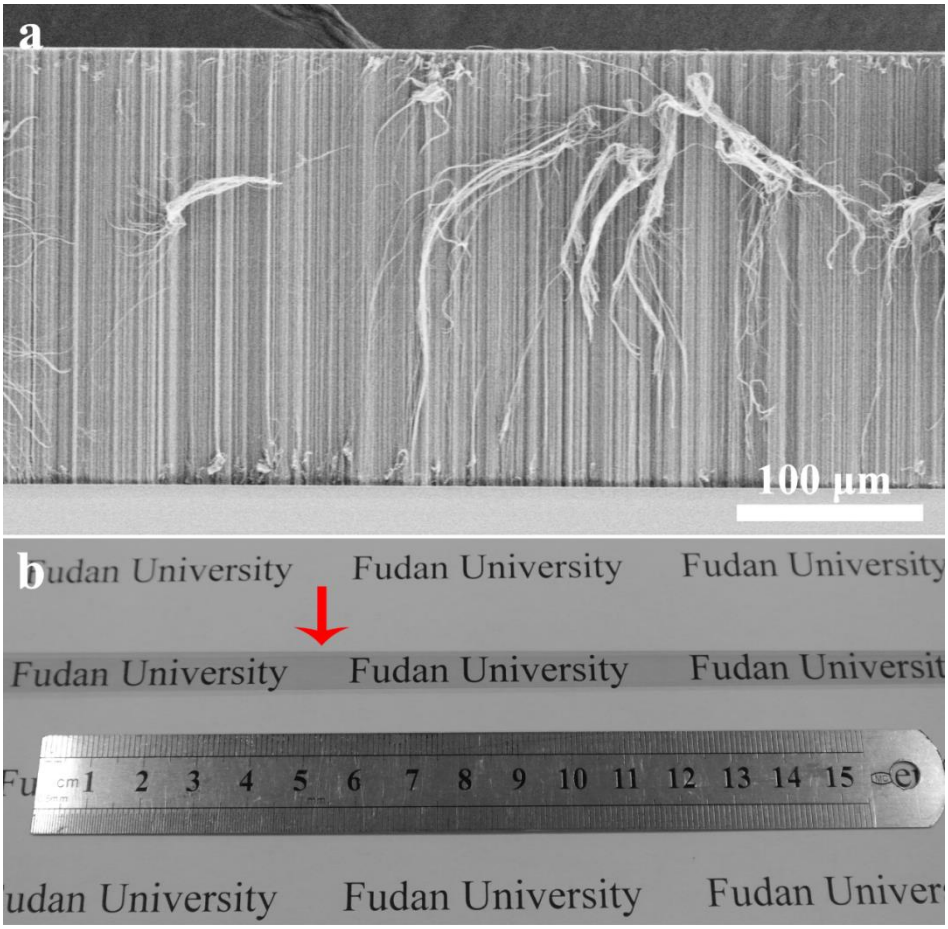

Figure S6. a. Side view of a spinnable CNT array with a height of 250 μm. **b.** A transparent conducting CNT sheet shown by the red arrow.