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Supporting Information

Single-crystal nanowire as electrodes for organic single-crystal nanodevices

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S1) The flexibility of nanowires

S2) The key step of device fabrication which depends on the excellent flexibility of the nanowire, and the weak van der Waals force between nanowire and substrate.

S3) Device fabrication process

S4) Measurement on channel length and channel width for the sandwich nanowire device

S5) Measurement on the dependence of the mobility on the channel length

S6) Spectra from the tungsten bromine lamp and solar light, and the absorption spectrum of $F_{16}CuPc$ and CuPc

S1) The flexibility of nanowires

The SnO_2:Sb nanowires could be bent over 180° without breaking. **Fig. S1** shows a single SnO_2:Sb nanowire with width of ~120 nm on the substrate surface They have the unique ability to be bent with a small radius of curvature to adhere on the substrate surface**,** showing their good flexibility. The minimum bending curvature radius r_c shown in Fig. S1 is 650 nm. The F_{16}CuPc and CuPc nanowires also have the excellent flexibility which has been shown in our previous reports.[1-3]

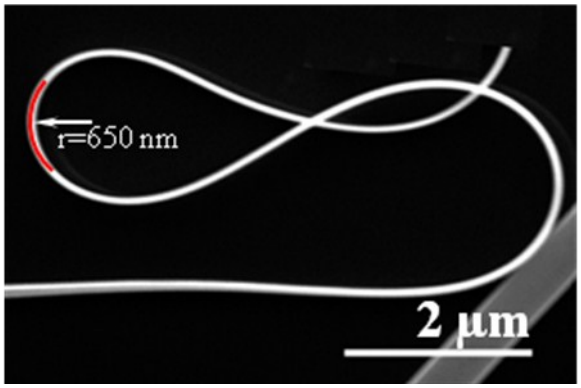

Fig. S1 SEM image of a single SnO_2:Sb nanowire on the substrate surface.

S2) The key step of device fabrication which depends on the excellent flexibility of the nanowire, and the weak van der Waals force between nanowire and substrate

The transferring of the nanowire is one key step for realization of device fabrication. **Fig. S2** show the transferring process of a single nanowire with a mechanical probe tip. The transferring process depends on the excellent flexibility of the nanowire, and the weak van der Waals force between nanowire and substrate. As shown in Fig. S2, the nanowire can be placed on the target substrate by continuously moving the tip backward and downward. The good flexibility of the nanowire ensures that it can be bent and manipulated by the probe tip, and be attached onto the target substrate step by step by controlling the movement of the probe tip. For SnO_2:Sb nanowire, the van der Waals force between nanowire and substrate is weak so that the nanowire can be placed on the substrate in the expected direction and even can be peeled from the substrate surface by moving the tip upward and forward.

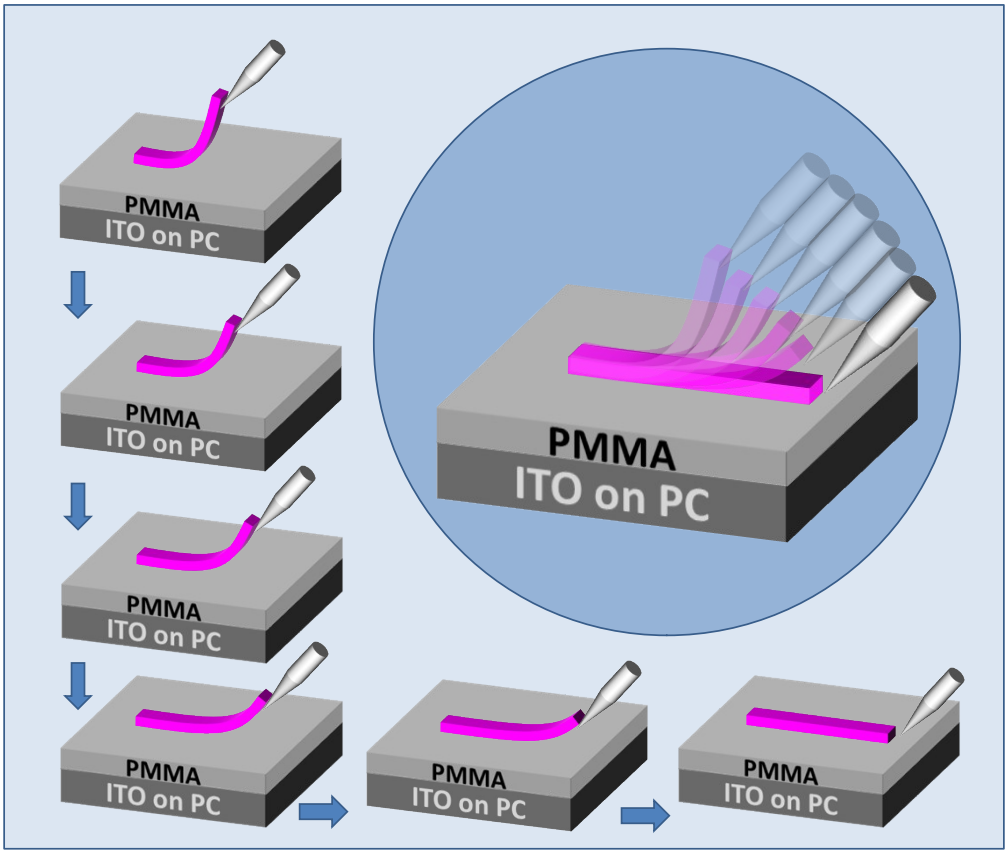

Fig. S2 Schematic images of the a single nanowire transferred onto the target substrate with a probe tip by a mechanical transfer process.

S3) Device fabrication process

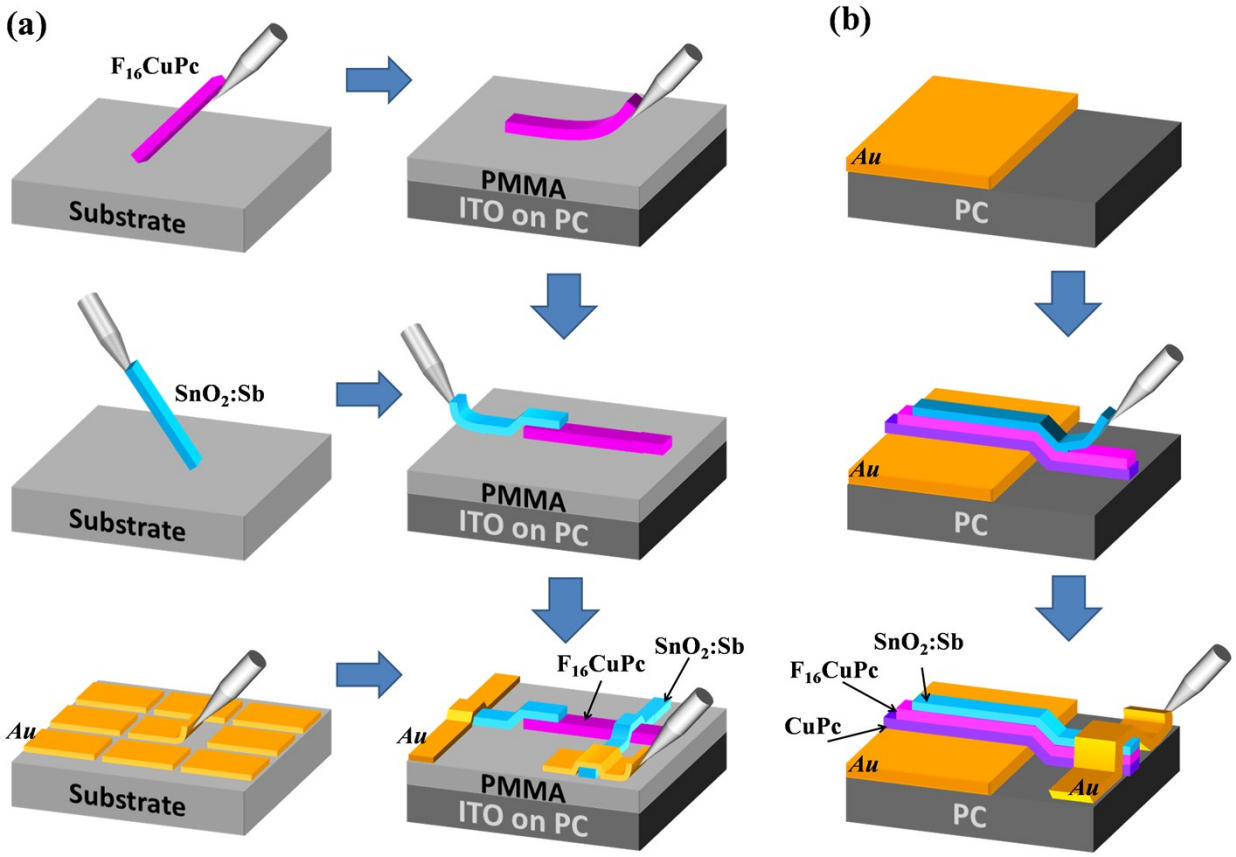

Fig. S3 Device fabrication process: (a) electrode-movable $F_{16}CuPc$ single-crystal nanowire OFETs, (b) CuPc/$F_{16}CuPc$ single-crystal nanowire p-n junction photovoltaic devices.

S4) Measurement on channel length and channel width for the sandwich nanowire device

Fig. S4 shows the magnified SEM images for the sandwich nanowire device. As shown in Fig. S4, the channel width is determined by the distance between the contact points of the $F_{16}CuPc$ nanowire and the SnO_2:Sb nanowire electrode (labeled as AB), the length is determined by the width of the $F_{16}CuPc$ nanowire.

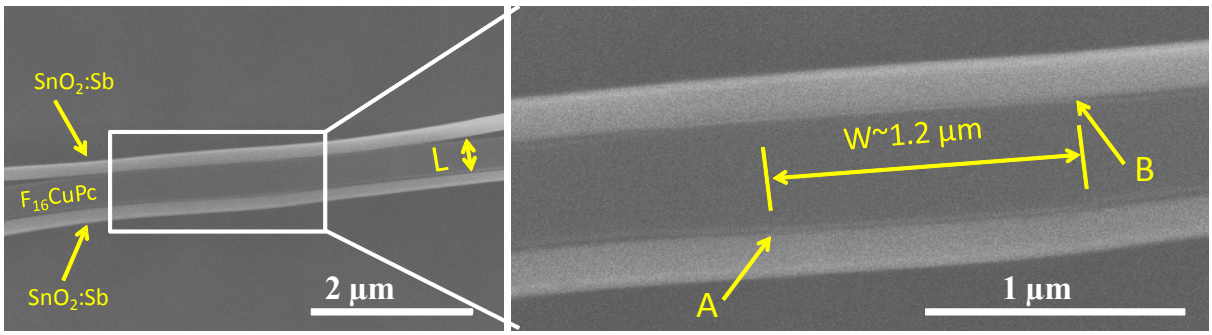

Fig. S4 Magnified SEM images for the sandwich nanowire device.

S5) Measurement on the dependence of the mobility on the channel length

In order to investigate the dependence of the mobility on the channel length, the crossed SnO_2:Sb nanowire electrode was moved with a mechanical probe tip. The channel length changed from 20 to 1.2 μm, and then from 1.2 to 23.5 μm (**Fig.s S5a-e**). Considering the electron irradiation damage on the organic micro/nanocrystal, an optical microscope of a Micromanipulator 6150 probe station was used to in situ record the location change of the SnO_2:Sb nanowire electrode. The channel length was determined by contrasting a series of the optical microscope images with the SEM image of the device with the terminal channel length at 23.5 μm (Fig. S5f). The channel length is obtained by the method as follows: first, we contrasted the optical image in Fig. S5e and the SEM image in Fig. S5f to define the contact point of the parallel F_{16}CuPc and SnO_2:Sb (labeled as A), the contact point of the one end of the parallel SnO_2:Sb and Au film (labeled as B), and the contact point of the crossed SnO_2:Sb nanowire and F_{16}CuPc (labeled as C). The real length of AB and AC (i.e., channel length L) can be obtained according to SEM image in Fig. S4f (AB=29.79 μm, AC=L=23.5 μm). When the crossed nanowire is slid, the C position is changed while A and B points remain unchanged in each optical microscope image (i.e., the length of AB remains unchanged. In the optical microscope images, by applying a ruler tool in Photoshop software, the measure length of AC and AB, which labeled as X_{AC} and X_{AB} can be obtained in Photoshop. Since the real length of AB is fixed at 29.79 μm when the nanowire is slid, the real length of AC, i.e., the channel length L, can be caculated by L/X_{AC}=29.79 $/X_{AB}$.

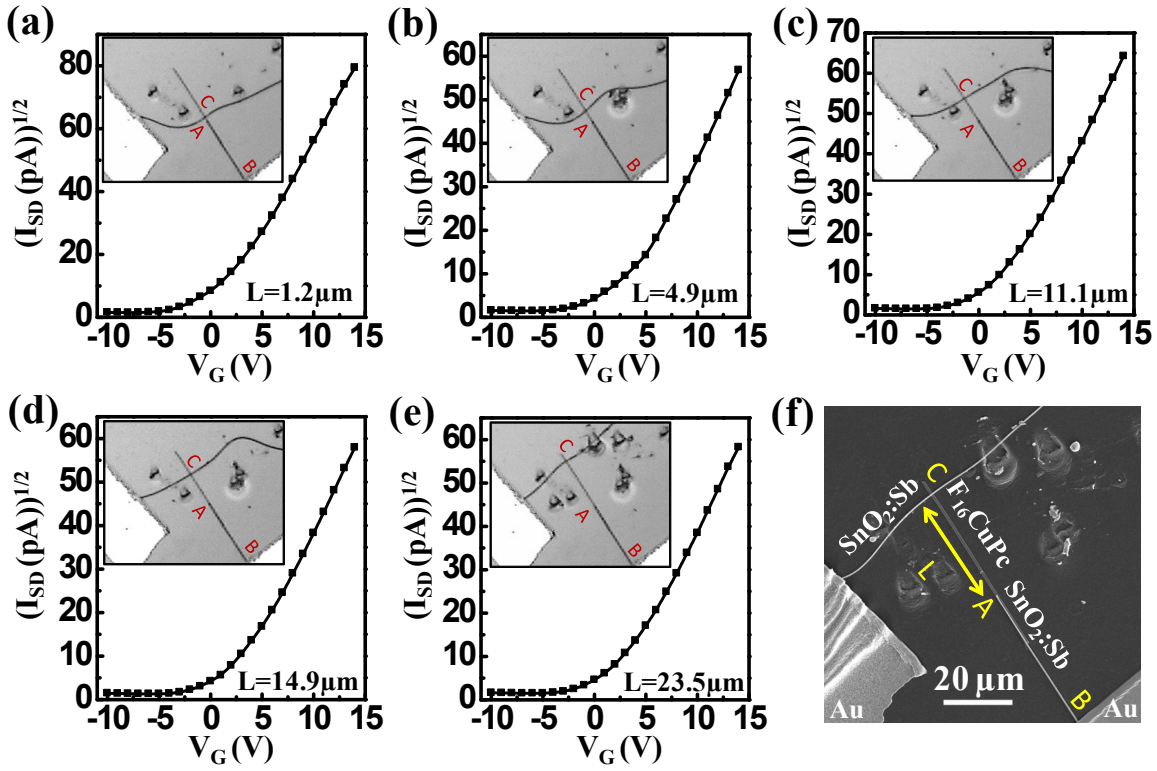

Fig. S5 (a-e)Transfer characteristics of the OFETs based on one F_{16}CuPc single-crystal nanowire at different channel length by moving the crossed SnO_2:Sb nanowire electrode. The insets give the corresponding optical microscopy images. (f) SEM image of the device with the channel length at 23.5 μm. A, B, and C respectively correspond to the contact point of the parallel F_{16}CuPc and SnO_2:Sb, the contact point of the one end of the parallel SnO_2:Sb and Au film, and the contact point of the crossed SnO_2:Sb nanowire and F_{16}CuPc nanowire.

S6) Spectra from the tungsten bromine lamp and solar light, and the absorption spectrum of F_{16}CuPc and CuPc.

In order to effeciently generate electron-hole pairs in a solar cell, light must reach the junction area and be absorbed effectively. Only those photons with energy larger than the semiconductor bandgap can be absorbed effectively. The bandgap of F_{16}CuPc/CuPc is ~1.5 eV and the absorption spectrum (**Fig. S6**) shows the photons with wavelength larger than ~850 nm could not be absorbed by F_{16}CuPc/CuPc (CuPc has the similar absorption specturm with F_{16}CuPc). Fig. S6 shows the spectral distribution of the solar light and the tungsten bromine lamp. Compared with the solar light, the longer wavelength regions always predominate in the tungsten bromine lamp (Fig. S6) which could not be absorbed by F_{16}CuPc/CuPc. Therefore, the effeicency of our photvoltaic device will decrease using the tungsten bromine lamp as lightsource compared with the sunlight source.[4,5]

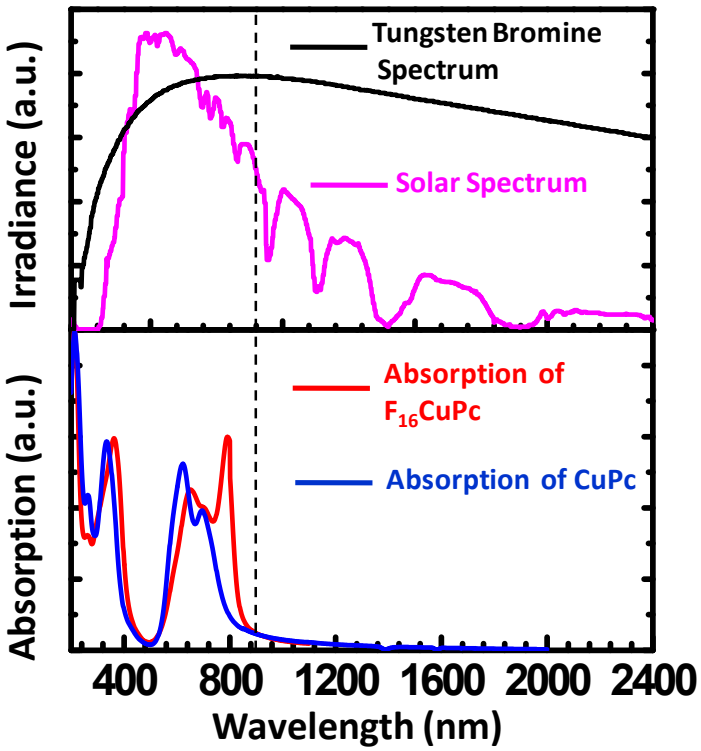

Fig. S6 Spectra from the tungsten bromine lamp and solar light, and the absorption spectrum of F_{16}CuPc and CuPc.

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