

*Supporting information for*

**One-step fabrication of ultralong nanobelts of PI-PTCDI and its optoelectronic properties**

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**Synthesis of PI-PTCDI**

The synthesis of N,N-bis-(1-propylimidazole)-3,4,9,10-perylene tetracarboxylic diimide (PI-PTCDI) was similar to the literature.<sup>14</sup> In a typical process, 2.3 g 3,4,9,10-Perylenetetracarboxylic dianhydride (PTCDA) and 4.4 g N-(3-aminopropyl)-imidazole were mixed and added to isobutanol (200 mL). The mixed solution was heated at 90 °C for 24 h with stirring under N<sub>2</sub> atmosphere. The final solution was filtered. The red powder was obtained as the crude product, and then washed with ultrapure water and ethanol. The obtained residue was treated with 150 mL 5% aqueous NaOH solution at 90 °C for 30 min to remove the unreacted PTCDA. The mixture was filtered, washed with ultrapure water and ethanol again, and dried under vacuum. The product was dark red solid with a yield of 86 %.

**Self-assembly of PI-PTCDI**

The PI-PTCDI powder was dissolved into chloroform with sonication at 50 °C for 1 h. The solution was filtered by using 0.22 µm filter head and then injected in the methanol ( $V_{\text{CHCl}_3}/V_{\text{CH}_3\text{OH}}=1:40$ ). Finally the mixture solution was stored at room temperature for about 2 days. The final solution was transparent and the precipitates were collected at the bottom. To remove the solvent thoroughly, the nanowire was post-annealed at 60 °C for 30 min.

**Characterization**

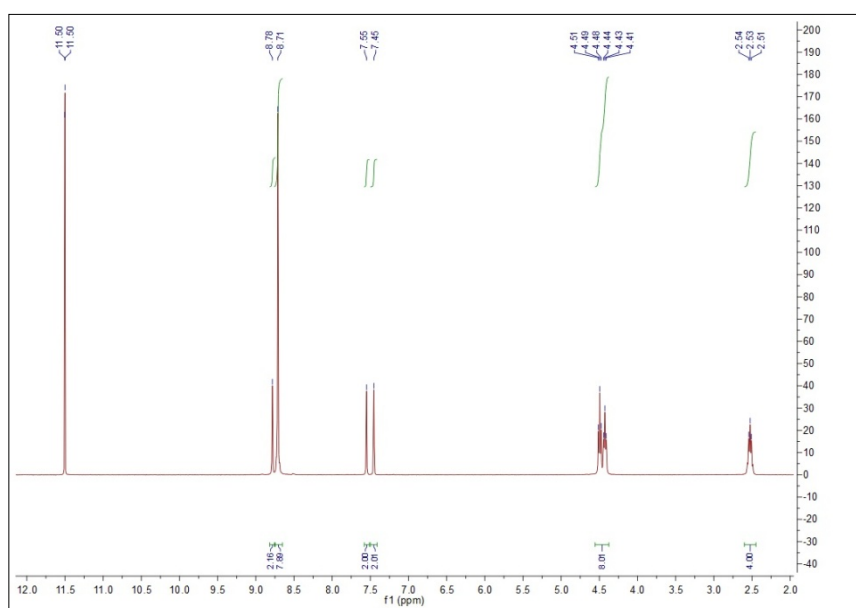
The product was characterized by <sup>1</sup>H and <sup>13</sup>C NMR nuclear magnetic resonance (HNMR, Varian MR 400 spectrometer operating at 400 MHz) and high resolution mass spectrometry (HRMS, Varian ProStar LC240).

N,N-bis-(1-propylimidazole)-3,4,9,10-perylene tetracarboxylic diimide:  $^1\text{H}$  NMR ( $\text{CF}_3\text{COOD}$ , 300 MHz, 25 °C),  $\delta/\text{ppm}$ : 2.51-2.54 (t, 4H), 4.41-4.44 (t, 4H), 4.48-4.5 (t, 4H), 7.45 (s, 2H), 7.55 (s, 2H), 8.71 (m, 8H), 8.78 (s, 2H). HRMS (ESI)  $m/z$  calculated for  $[\text{C}_{36}\text{H}_{26}\text{N}_6\text{O}_4+\text{H}]^+$ ,  $[\text{M}+\text{H}]^+$ , 607.2; found. 607.3.

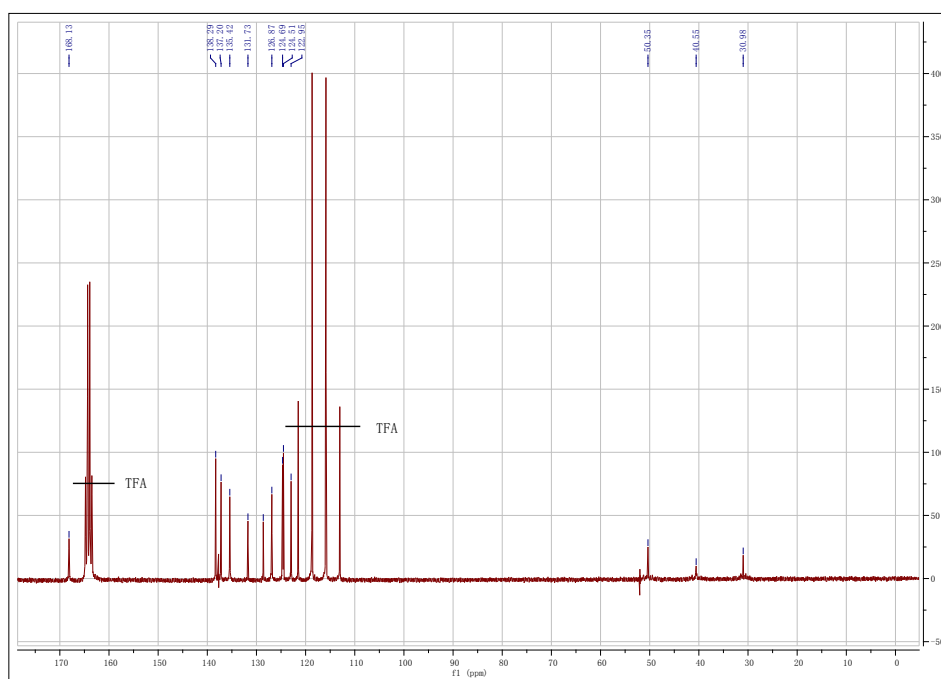
The morphology and crystalline structures of PI-PTCDI nanobelts were characterized by scanning electron microscopy (SEM, Quanta 400 FEG), transmission electron microscopy (TEM, Tecnai G2 F20 S-Twin), X-ray diffraction (XRD, Bruker D8 Advance X-Ray Diffractometer), Raman spectroscopy (Labram HR 800 UV-NIR), UV-vis absorption spectroscopy (Perkin Elmer Lambda 25), and Fourier-transform infrared spectroscopy (FT-IR, Thermo Fisher Scientific FTIR 6700).

### **Device Fabrication and Measurement**

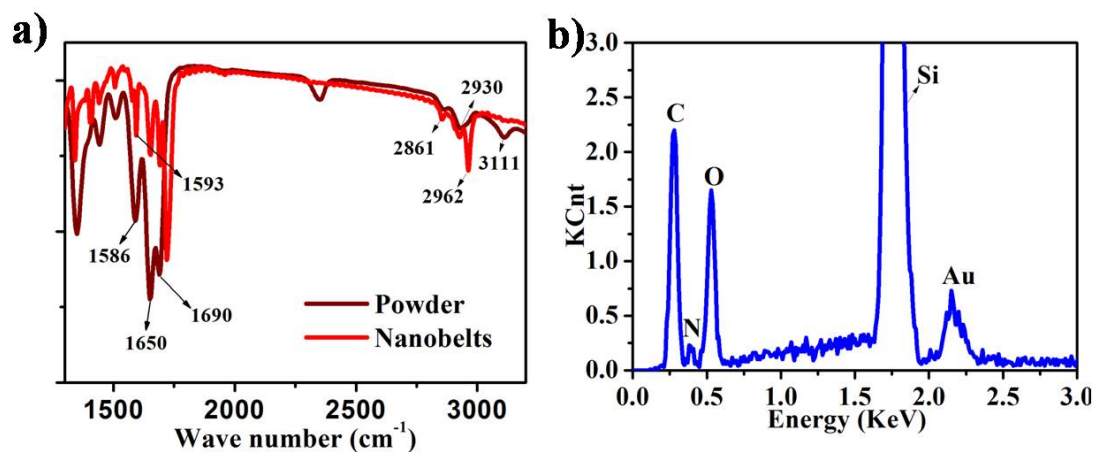
The photodetectors were constructed in bottom-connected configuration. The finger electrodes with the length of 200  $\mu\text{m}$ , the width of 20  $\mu\text{m}$ , and the distance of 20  $\mu\text{m}$  were fabricated by photolithography and electron beam deposition of Au onto  $\text{SiO}_2/\text{Si}$  substrate. PI-PTCDI nanobelts dispersed in methanol were directly deposited on the pre-patterned Au electrodes. The solvent was allowed to evaporate in air. To remove the solvent thoroughly and enhance the contact between nanobelts and Au electrodes, the device was also post-annealed at 60 °C for 30 min. Current-voltage characteristics of the devices were recorded with Keithley 4200 SCS and SUSS PM8 probe station in a clean and shielded box at room temperature. A Xenon lamp was used as the white light source with different intensity. All measurements were carried out at ambient conditions.



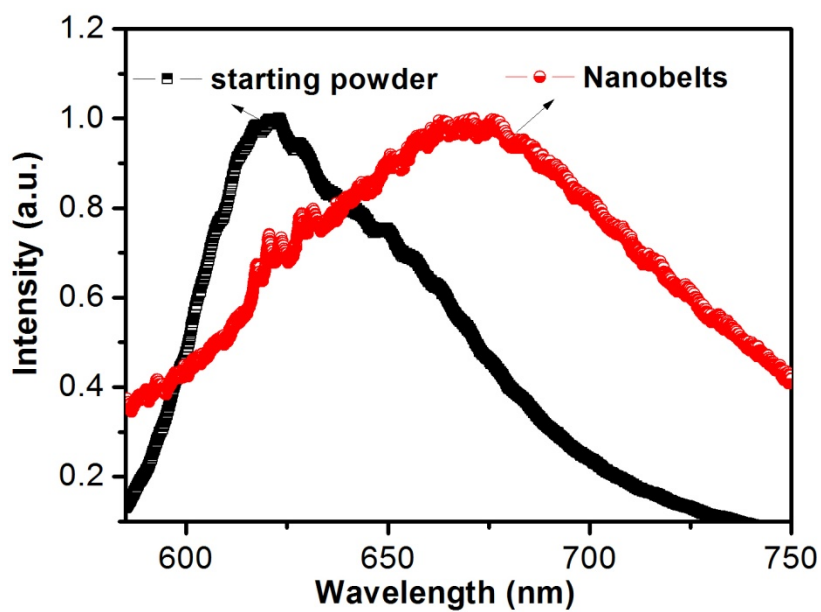
**Fig. S1.** <sup>1</sup>H NMR spectrum of PI-PTCDI powder



**Fig.S2.** <sup>13</sup>C NMR spectrum of PI-PTCDI powder



**Fig.S3.** (a) FT-IR spectra of nanobelts and source powder of PI-PTCDI. (b) EDX spectrum of PI-PTCDI nanobelts.



**Fig. S4.**Emission spectra of nanobelts and source powder of PI-PTCDI.