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) were was similar to the literature.\textsuperscript{14} 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\textsubscript{2} 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 \textmu m filter head and then injected in the methanol (V\textsubscript{CHCl\textsubscript{3}}/V\textsubscript{CH\textsubscript{3}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 \textsuperscript{1}H and \textsuperscript{13}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 tetracarboxylicdiimide:

$^1$H NMR (CF$_3$COOD, 300 MHz, 25 °C), δ/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 [C$_{36}$H$_{26}$N$_6$O$_4$+H]$^+$, [M+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 μm, the width of 20 μm, and the distance of 20 μm were fabricated by photolithography and electron beam deposition of Au onto SiO$_2$/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. $^1$H NMR spectrum of PI-PTCDI powder

Fig. S2. $^{13}$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.