Engineering of Interfacial Electron Transfer from Donor-acceptor Type Organic Semiconductor to ZnO Nanorod for Visible-light Detection

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Supporting Information

Supporting Figures

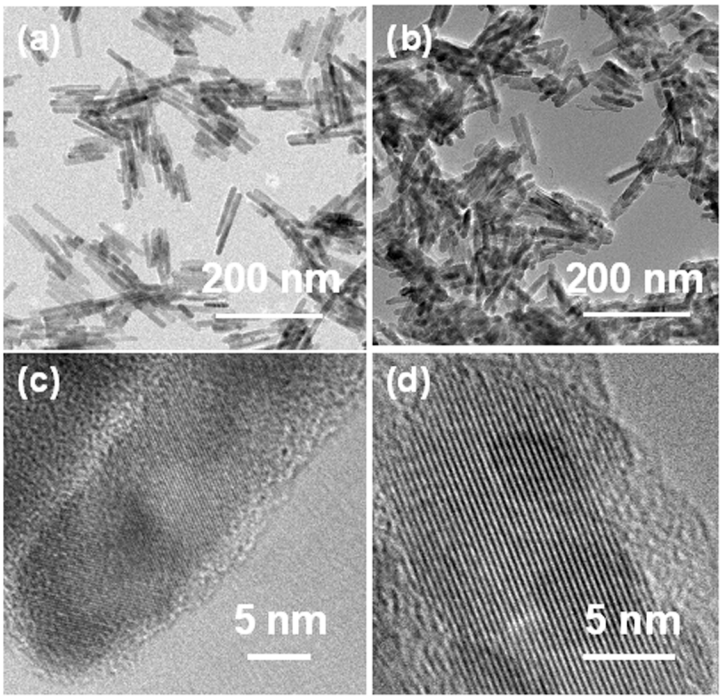

Figure S1. Low-magnification TEM images of ZnO nanorods (a) before and (b) after grafting of 1T-PBI compound on the surface of ZnO nanorods. High-magnification of hybrid ZnO nanorods after the grafting of (c) PBI and (d) 2T-PBI compounds. Through measured about 33 nanorods randomly in Figure R2a and Figure R2b, the average diameter of ZnO nanorods in Figure S1a is about 12.0 ± 2 nm and in Figure S1b is about 12.5 ± 2 nm. It is shown that the diameter of the ZnO nanorods before and after grafting organic compounds keeps almost the same considering the relatively large error.

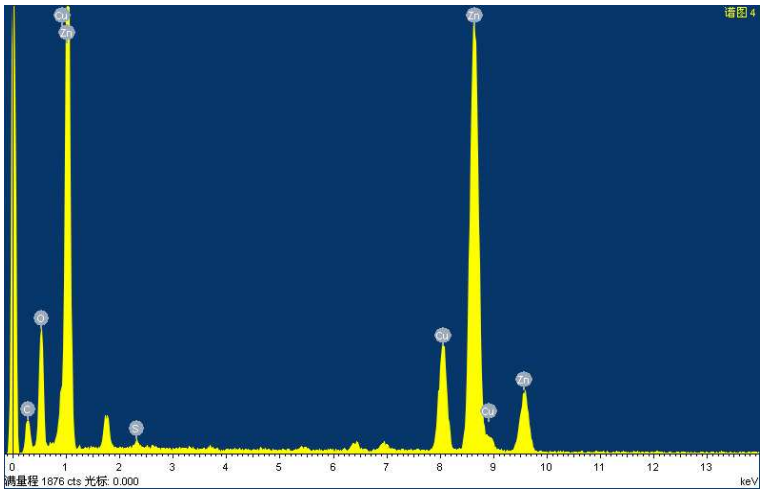

Figure S2. Energy-dispersive X-ray spectroscopy of 1T-PBI/ZnO hybrid nanocomposite. The existence of S elements indicates the presence of 1T-PBI compound on the surface of ZnO nanorods.

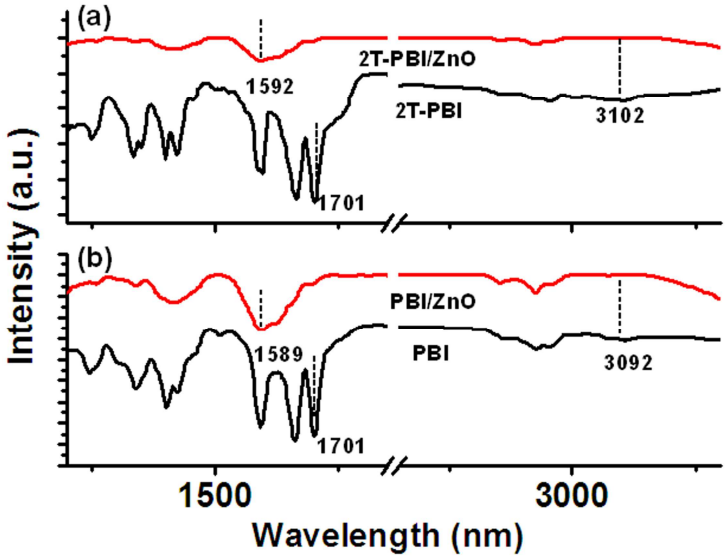

Figure S3. FT-IR spectra of (a) 2T-PBI compound (black) and 2T-PBI/ZnO hybrid composite (red), (b) PBI compound (black) and PBI/ZnO hybrid (red). (i) The broad –OH stretching peak around 3100 cm^{-1} and C=O stretching at 1701 cm^{-1} in the spectra of 2T-PBI and PBI solid are factually absent from the spectra of hybrid 2T-PBI/ZnO and PBI/ZnO excluding the presence of free oleic acid in the latter. (ii) The broad O–C–O stretching band at 1592 cm^{-1} or 1589 cm^{-1} in the spectra of 2T-PBI/ZnO and PBI/ZnO hybrids indicates the formation of carboxylate species with the O atoms bonding to a single or two neighboring Zn atoms.

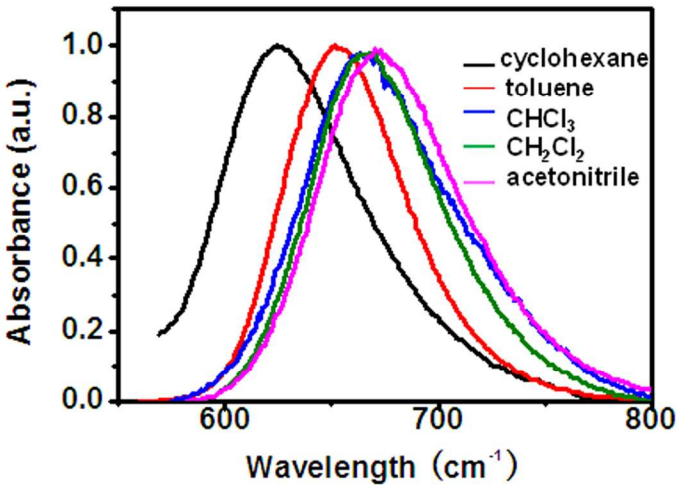

Figure S4. Fluorescence spectrum of 1T-PBI in different solvent.

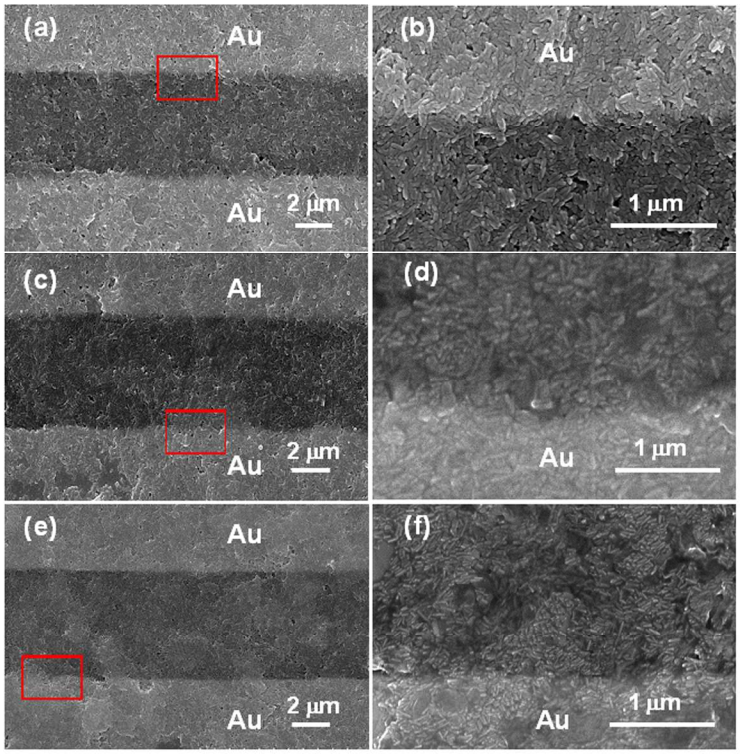

Figure S5. SEM images of the devices gaps for (a) ZnO nanorods and (b) the magnification of the bridging area between ZnO nanorods and Au electrode marked in red box in Figure (a), (c) 1T-PBI/ZnO hybrid composite devices and (d) the magnification of the bridging area between ZnO nanorods and Au electrode marked in red box in Figure (c). (e) 2T-PBI/ZnO hybrid composite devices and (f) the magnification of the bridging area between ZnO nanorods and Au electrode marked in red box in Figure (e).

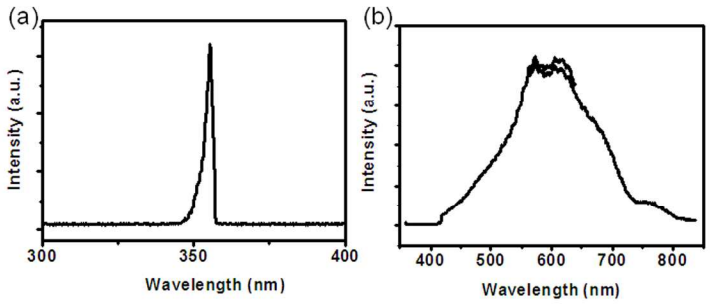

Figure S6. The spectra of (a) UV light filtered from xenon lamp (λ = 350~360 nm) and (b) iodine-tungsten lamp (λ = 450~750 nm).

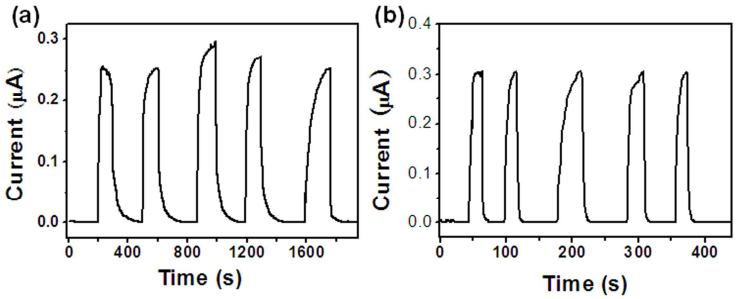

Figure S7. On/off switching behavior of 1T-PBI/ZnO and 2T-PBI/ZnO hybrid device at 12 V/μm, under 2.34 mW/cm^2 visible-light illumination.