

Electronic supplementary information (ESI)

A Highly Sensitive Near-infrared Organic Photodetector Based on Oxotitanium Phthalocyanine Nanocrystals and Light-induced Enhancement of Electron Tunnelling

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Estimation of the average distance between neighboring Y-TiOPc NPs in Y-TiOPc@PC.

To estimate the average insulating space between neighboring Y-TiOPc NPs in Y-TiOPc@PC with 20 wt% of Y-TiOPc in the film, we regard the Y-TiOPc nanoparticles as spheres of 3.4-nm in diameter and assume that the Y-TiOPc@PC film is built by stacking many cubes with the edge length of x nm, and that each such cube is consisted of the polycarbonate resin (PCZ-300) and a single Y-TiOPc nanoparticle in the middle (Fig. S1). Then, the average distance between neighboring Y-TiOPc NPs in Y-TiOPc@PC will be $(x - 3.4)$ nm.

In order to get the x value, we calculate the masses of Y-TiOPc and PCZ-300 in one aforementioned cube based on the volume and the density of Y-TiOPc (1.25 g ml^{-1} , measured by the Archimedes drainage method), as well as the volume and the density of PCZ-300 (1.2 g ml^{-1} , data provided by the manufacturer), respectively:

$$m(Y - TiOPc) = 1.25 * \frac{4}{3} \pi \left(\frac{3.4 * 10^{-7}}{2} \right)^3$$

$$m(PCZ - 300) = 1.2 * \left[(x * 10^{-7})^3 - \frac{4}{3} \pi \left(\frac{3.4 * 10^{-7}}{2} \right)^3 \right]$$

For an aforementioned cube with 20 wt% of Y-TiOPc, we have

$$\frac{m(Y - TiOPc)}{m(PCZ - 300)} = \frac{1}{4}$$

Then the x value is calculated to be 4.7, and the average distance between two neighboring Y-TiOPc NPs is estimated to be 1.3 nm. In fact, there must be distributions of particle-particle distances and the particle shapes in the single-layered photodetector.

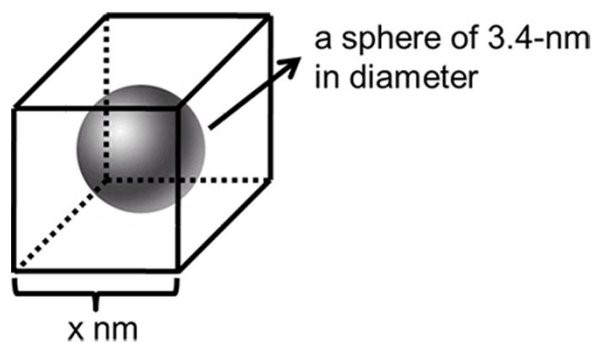


Fig. S1 Scheme of the stacking cube in Y-TiOPc@PC, with the Y-TiOPc particle locating at the center of the cube.

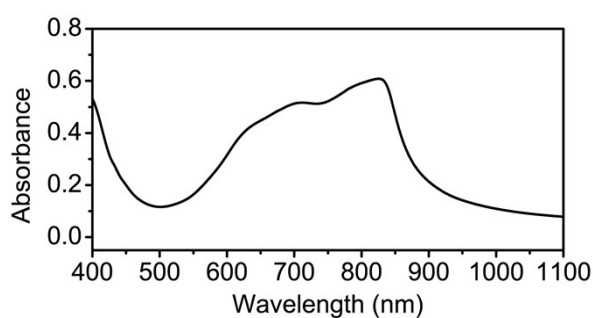


Fig. S2 UV-vis absorption spectrum of Y-TiOPc nanoparticles. The sample was prepared by depositing the colloidal Y-TiOPc nanoparticles on a quartz plate.

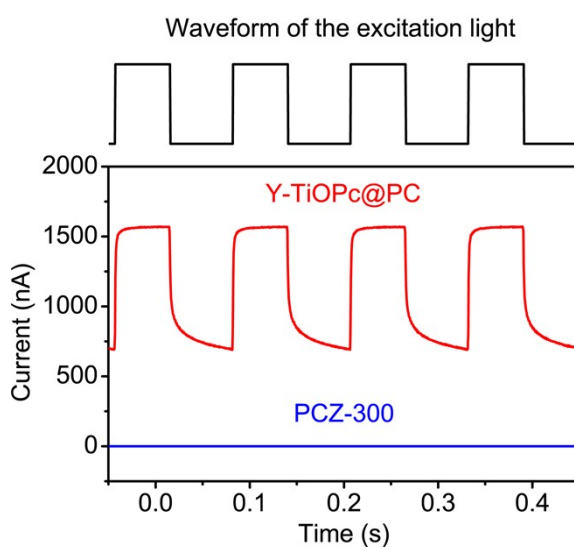


Fig. S3 The transient photocurrent response of the Y-TiOPc@PC single-layered photodetector and a film of the polycarbonate resin measured under illumination of a modulated 808 nm laser (8 Hz) having a light intensity of 1 mW cm^{-2} and an electric field of 225 kV cm^{-1} .