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Supplementary Information for Publication

Electrogenerated Chemiluminescence and Interfacial Charge Transfer Dynamics of Poly (3-hexylthiophene-2, 5-diyl) (P3HT)-TiO_2 Nanoparticle Thin Film

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Figure S1. ECL experiment geometry. Counter and QRE electrodes were Pt and Ag wires, respectively. Scan rate: 0.1 V/s; 500 V DC on PMT. All samples were prepared on ITO glass by spin coating.

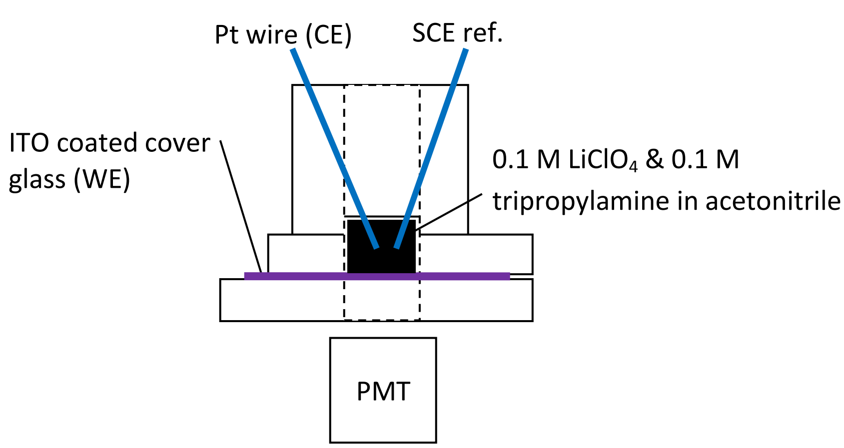


Figure S2. Typical ECL spectrum obtained from P3HT thin film collected using a spectrometer and CCD camera (Acton Spec-10:100B and Acton SP-2558, Princeton instruments) while ECL was generated from a P3HT coated thin film electrode using a bipotentiostat CHI 760C.

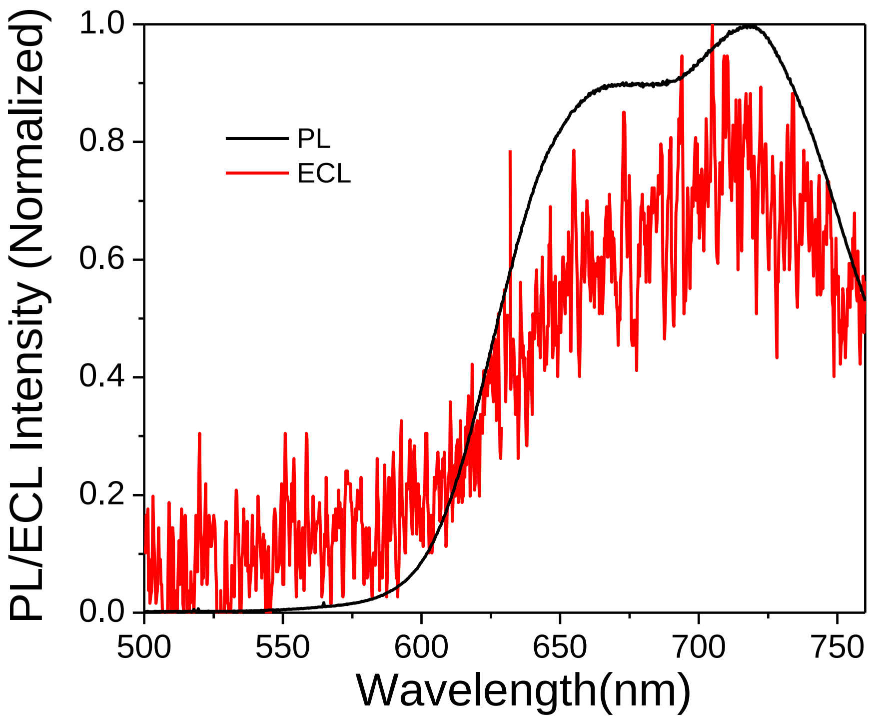
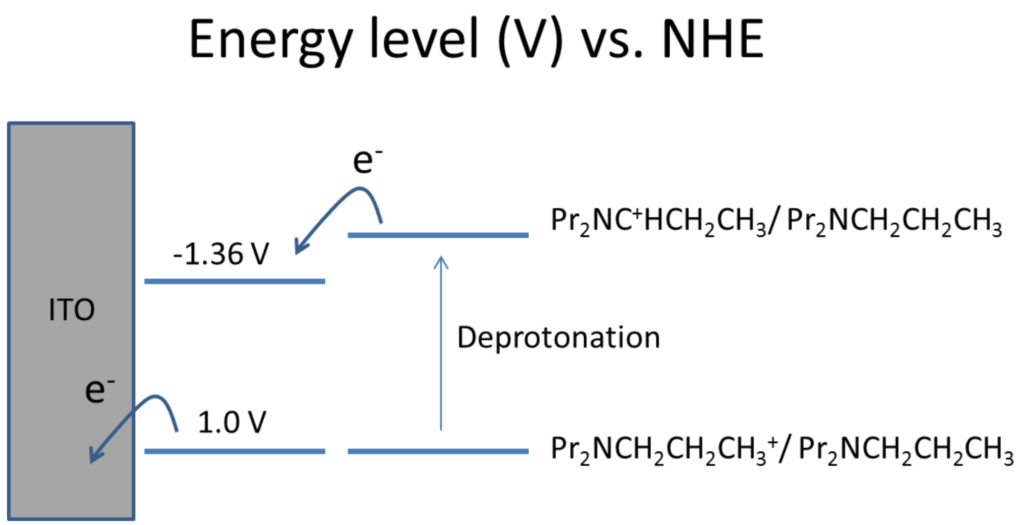


Figure S3. Energy alignment of redox species for charge injection and ECL generation.



Surface area calculations

$$\sigma_{TiO_2} = n_{NPs}\sigma_{NP}$$

$$n_{NPs} = \frac{\%_{TiO_2} m_{film}}{\rho_{TiO_2} V_{NP}}$$

$$\sigma_{TiO_2} = \frac{\%_{TiO_2} m_{film}}{\rho_{TiO_2} V_{NP}}\sigma_{NP} = \frac{\%_{TiO_2} m_{film}}{\rho_{TiO_2}}\frac{4\pi r_{NP}^2}{\frac{4}{3}\pi r_{NP}^3} = \frac{3\%_{TiO_2} m_{film}}{\rho_{TiO_2} r_{NP}}$$

$$\rho_{film} = \frac{m_{film}}{V_{film}} = \frac{m_{film}}{\frac{m_{P3HT}}{\rho_{P3HT}} + \frac{m_{TiO_2}}{\rho_{TiO_2}}} = \frac{m_{film}}{\left(\frac{\%_{P3HT}}{\rho_{P3HT}} + \frac{\%_{TiO_2}}{\rho_{TiO_2}}\right) m_{film}} = \frac{\rho_{P3HT}\rho_{TiO_2}}{\%_{P3HT}\rho_{TiO_2} + \%_{TiO_2}\rho_{P3HT}}$$

$$\rho_{film} = \frac{\rho_{P3HT}}{\%_{P3HT} + \%_{TiO_2}\frac{\rho_{P3HT}}{\rho_{TiO_2}}} = \frac{\rho_{P3HT}}{\left(1-\%_{TiO_2}\right) + \%_{TiO_2}\frac{\rho_{P3HT}}{\rho_{TiO_2}}} = \frac{\rho_{P3HT}}{1+\left(\frac{\rho_{P3HT}}{\rho_{TiO_2}} - 1\right)\%_{TiO_2}}$$

$$\frac{\sigma_{TiO_2}}{V_{film}} = \frac{\sigma_{TiO_2}\rho_{film}}{m_{film}} = \left(\frac{3\%_{TiO_2}}{\rho_{TiO_2} r_{NP}}\right)\left(\frac{\rho_{P3HT}}{1+\left(\frac{\rho_{P3HT}}{\rho_{TiO_2}} - 1\right)\%_{TiO_2}}\right) = \frac{3\frac{\rho_{P3HT}}{\rho_{TiO_2}}\%_{TiO_2}}{r_{NP}\left(1+\left(\frac{\rho_{P3HT}}{\rho_{TiO_2}} - 1\right)\%_{TiO_2}\right)} = 8.5\times10^5\, cm^{-1}\left(\frac{\%_{TiO_2}}{1-0.72\%_{TiO_2}}\right)$$

where σ_{TiO_2} is the total surface area of TiO_2,
V_{film} is the volume of the P3HT/TiO_2 film,
ρ_{P3HT} and ρ_{TiO_2} are the P3HT and densities,
r_{NP} is the radius of the nanoparticles,
and $\%_{TiO_2}$ is the fraction (by weight) of TiO_2 in the film.

Figure S4. *J*-*V* characteristics of P3HT/TiO_2 hybrid with 80 wt% content of spherical-shaped TiO_2 nanoparticles solar cells.