Electronic Supplementary Information

Low-power supralinear photocurrent generation via excited state fusion in single-component nanostructured organic photodetectors

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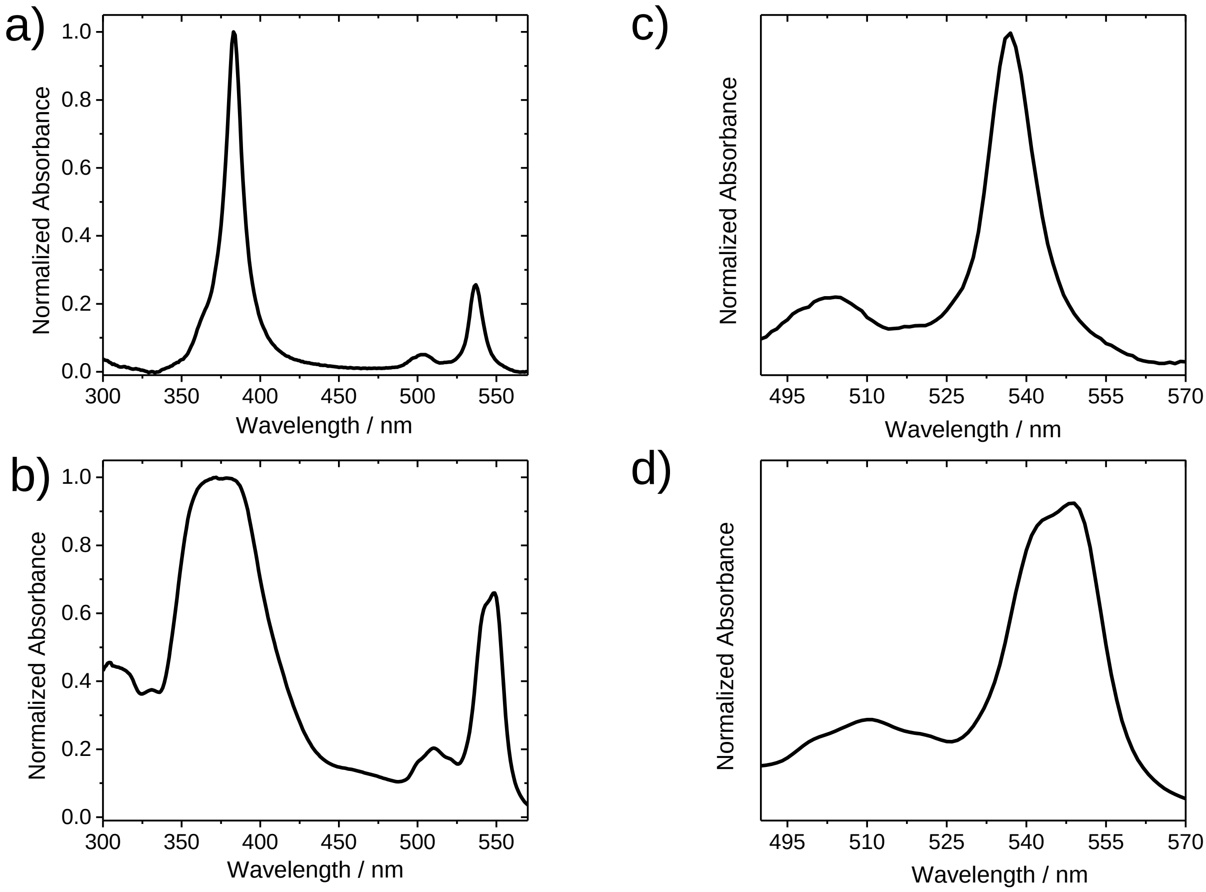

Figure S1. Normalized absorption spectra of a) PS:PtOEP 10 wt% film developed by spin-coating of a toluene solution, b) thermally evaporated PtOEP film. Selected spectral ranges of (a) and (b) that present the normalized Q-band absorption spectra of c) PS:PtOEP 10 wt% film developed by spin-coating of a toluene solution and d) thermally evaporated PtOEP film.

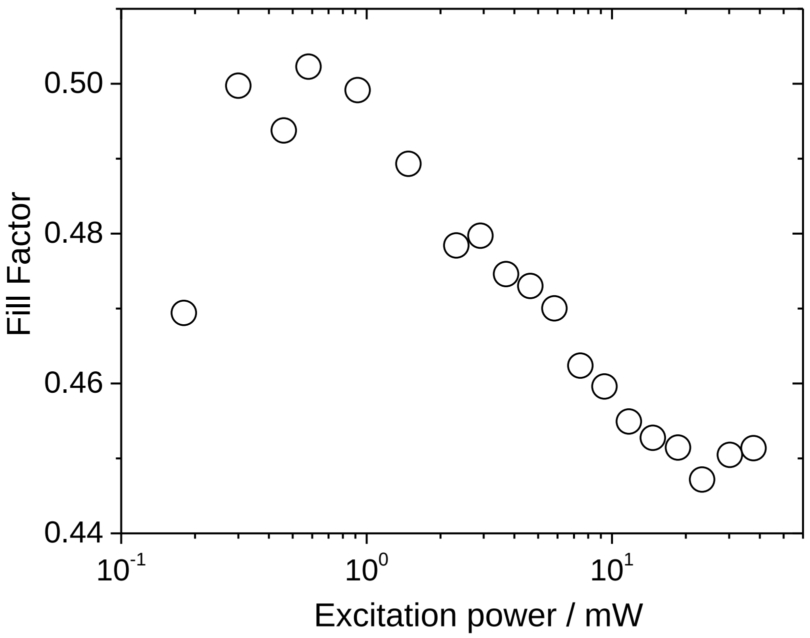

Figure S2. Device fill factor (FF) as a function of the excitation laser power for the PtOEP-based photodiode. In all cases, FF was determined based on Eq. 1 when the corresponding photocurrent *J-V* curves of Figure 4a in the main manuscript were used.

$$FF = \frac{P_{MP}}{V_{oc} \times I_{sc}} \qquad \text{Eq. 1}$$

In Equation 1, V_{OC} and I_{SC} correspond to the open-circuit voltage and the short-circuit current device parameters, whereas P_{MP} represents the maximum power of the PtOEP-only device with $P_{MP} = V_{MP} \times I_{MP}$; V_{MP} and I_{MP} correspond to the photovoltage and photocurrent where the maximum power is obtained.

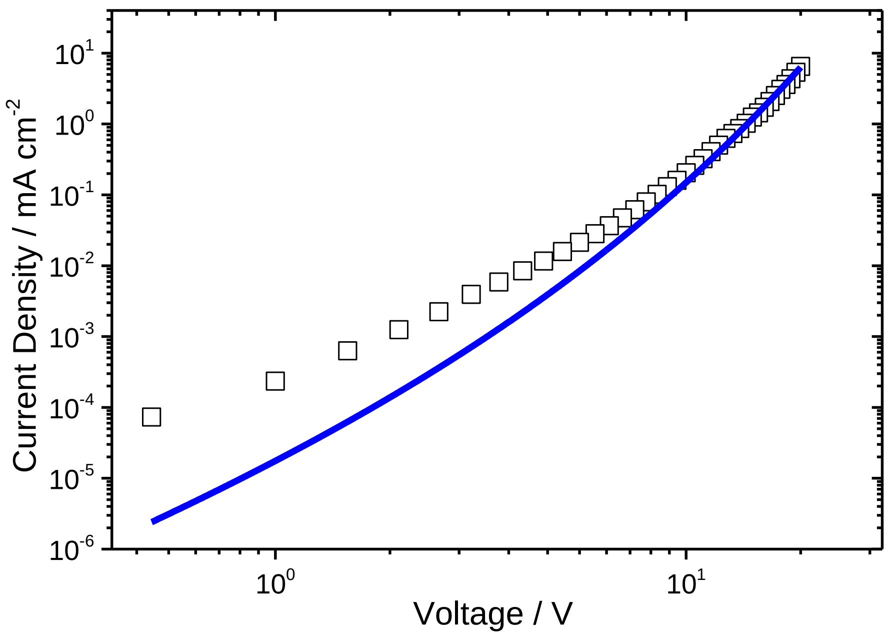

Figure S3. Dark J-V curves of a hole-only PtOEP device with the ITO/PEDOT:PSS/active layer/Au configuration. The solid line is fit to the data according to Eq. 2

$$J(V) = \frac{9}{8}\varepsilon_0 \varepsilon_r \mu_0 \frac{V^2}{L^3}\, e^{0.89\beta\sqrt{\frac{V}{L}}} \qquad \text{Eq. 2}$$

Equation 2 corresponds to a modified Mott-Gurney equation, by considering the Poole-Frenkel effect [1], where ε_0 and ε correspond to the vacuum permittivity and the material dielectric constant respectively, μ_0 is the zero-field hole mobility, V corresponds to the applied voltage and L corresponds to the active layer thickness.

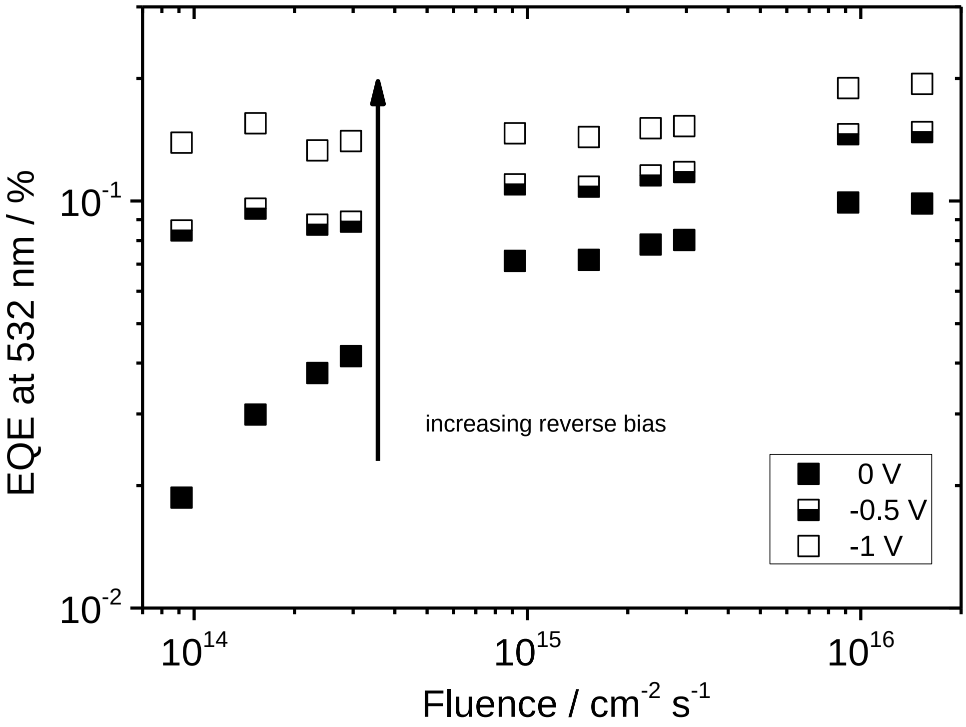

Figure S4. Fluence dependent EQE values of the PtOEP-only photodetector, as obtained after 532 nm cw-laser photoexcitation at three different operative conditions: at short-circuit (filled squares), at -0.5 V reverse bias (semi-filled squares) and at -1 V reverse bias (open squares)

REFERENCES.

1. F. Machui, S. Rathgeber, N. Li, T. Ameri, C. J. Brabec, Influence of a ternary donor material on the morphology of a P3HT:PCBM blend for organic photovoltaic devices *J. Mater. Chem.*, 2012, **22**, 15570-15577