Supporting Information

Measurement of the Triplet Exciton Diffusion Length in Organic Semiconductors

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1. Outcoupled Photoluminescence Efficiency Ratio

The outcoupled PL efficiency can be calculated by direct injection of excitons into the sensitizer from an adjacent layer as shown in Fig. S1, thereby setting η_T equal to 1.

$$\frac{\eta_{Sensitizer}^{PL}}{\eta_{Injector}^{PL}} = \frac{\Delta PL^{Sensitizer}}{\Delta PL^{Injector}} \qquad (1)$$

where $\Delta PL^{Sensitizer}$ and $\Delta PL^{Injector}$ are the change in photoluminescence (PL) of the injector and sensitizer layers in the case when the two layers are adjacent to each other and when each layer is replaced by the wide gap exciton blocking layer.

$$\Delta PL_{Injector} = PL^{Injector} - PL_{Sensitizer}^{Injector}$$
$$\Delta PL_{Sensitizer} = PL_{Injector}^{Sensitizer} - PL^{Sensitizer}$$

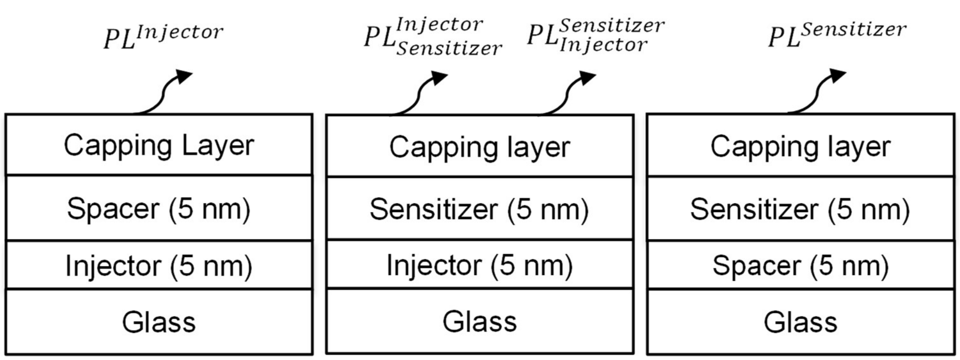

Figure S1: Architecture for extracting the outcoupled PL efficiency ratio.

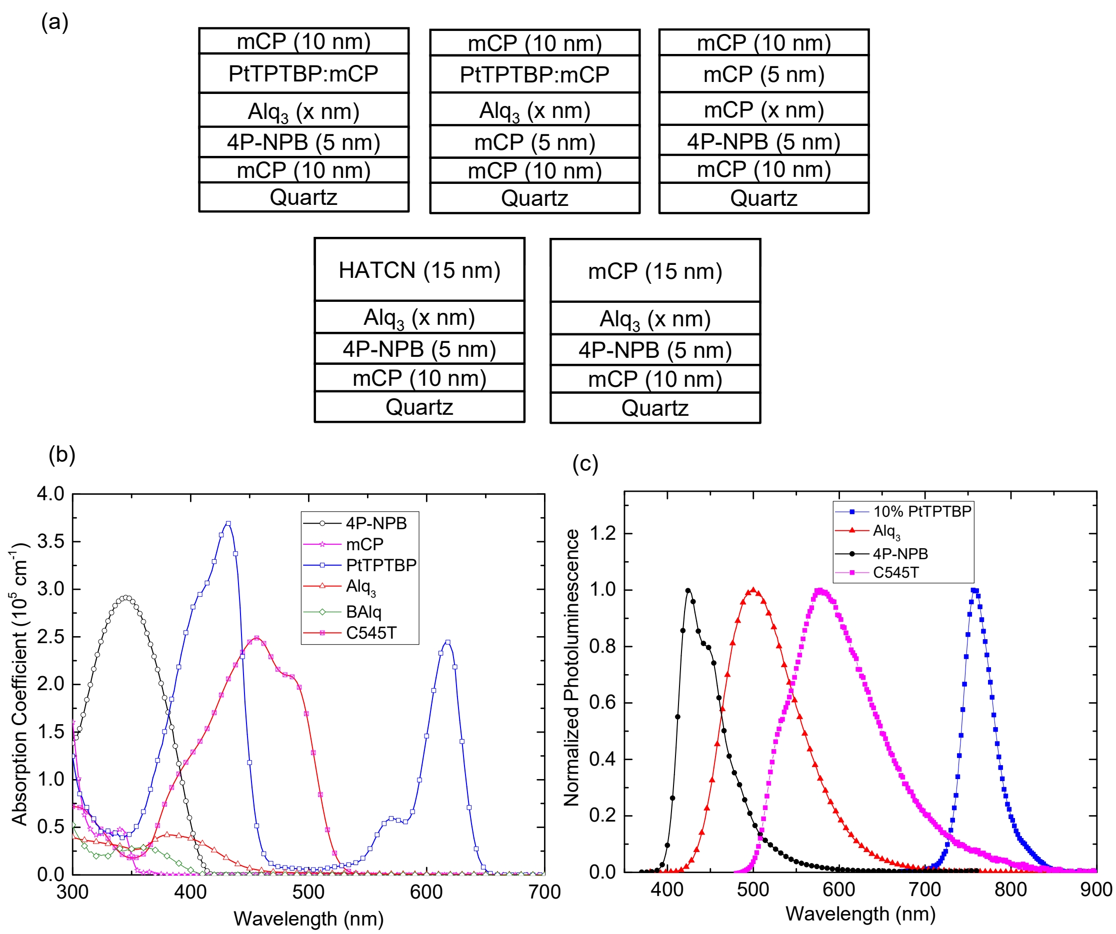

Figure S2: (a) Device architecture for measuring the singlet exciton diffusion length of Alq_3 using the phosphorescent sensitizer-based approach and thickness dependent photoluminescence quenching. The excitons diffusing through Alq_3 are captured using 10 wt.% PtTPTBP doped in mCP. **(b)** Absorption coefficient of Alq_3, BAlq, C545T, 4P-NPB, mCP and PtTPTBP. The absorption coefficient was calculated from the extinction coefficient extracted from ellipsometric measurements on a 30-nm-thick film deposited on a glass substrate. **(c)** Normalized photoluminescence of Alq_3, C545T, 4P-NPB and 10 wt.% PtTPTBP in mCP.

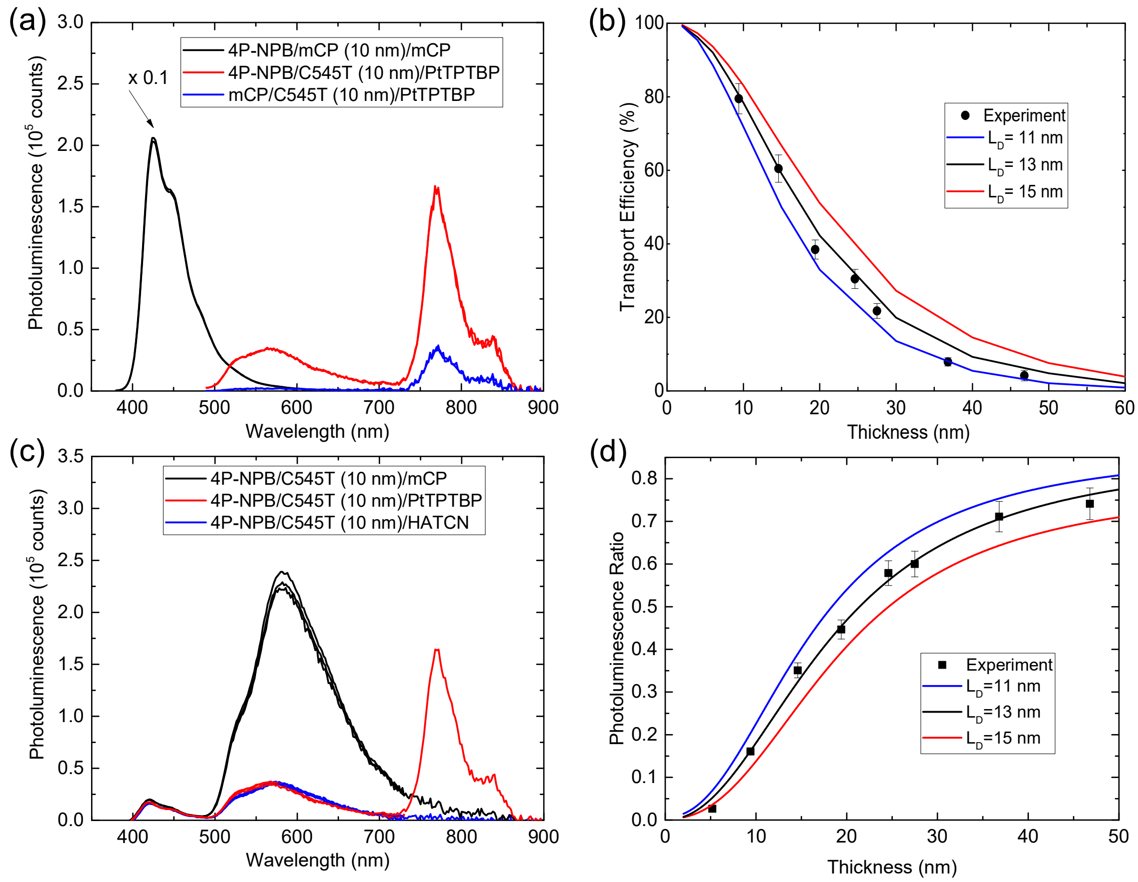

Figure S3: (a) Representative photoluminescence spectra for the architectures (structures (4P-NPB (5 nm)/mCP (10 nm)/mCP(15 nm), 4P-NPB (5 nm)/C545T (10 nm)/45 wt.% PtTPTBP:mCP (5 nm)/mCP (10 nm), and mCP (5 nm)/C545T (10 nm)/ 45 wt.% PtTPTBP:mCP (5 nm)/mCP (10 nm)) used to probe the singlet diffusion length of C545T using the phosphorescent sensitizer-based approach. C545T singlet excitons in a neat film emit at a peak wavelength λ=575 nm. The structure is pumped at a wavelength of λ=370 nm where the majority of excitons are generated in the injection layer of 4P-NPB. Excitons diffusing through C545T are harvested using a film of 45 wt.% PtTPTBP doped in mCP. (b) Experimental and simulated (line) transport efficiency as a function of transport layer thickness. An L_D of (12.2 $\pm$ 0.7) nm is extracted from KMC simulations. (c) Representative photoluminescence spectra for the architectures (4P-NPB/C545T (10 nm)/mCP and 4P-NPB/C545T (10 nm)/HATCN) used to probe the singlet diffusion length of C545T using thickness dependent photoluminescence quenching. (d) Photoluminescence ratio versus thickness for determination of singlet L_D of C545T. An L_D of (12.4 $\pm$ 0.8) nm is extracted by fitting experimental data using a 1D steady-state diffusion equation.