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Supporting Information

BODIPY-pyrene donor-acceptor sensitizers for triplet-triplet annihilation upconversion: the impact of BODIPY-core on upconversion efficiency

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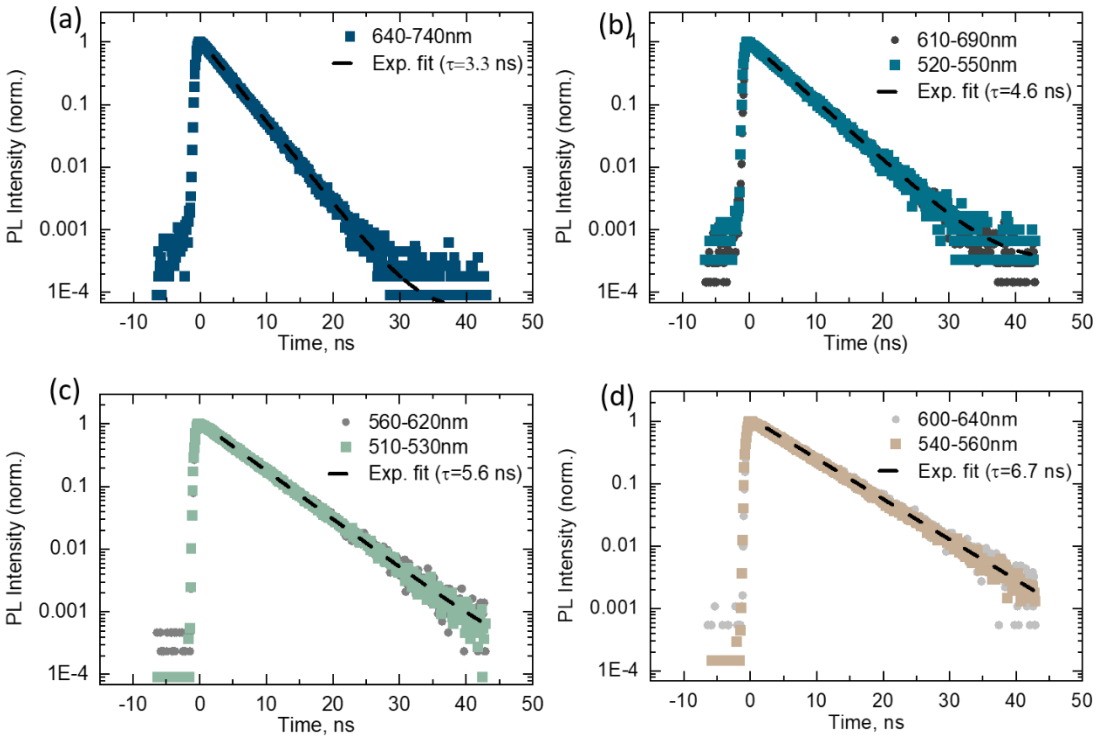

Figure S1. Photoluminescence decays of the BPD1 (a), BPD2 (b), BPD3 (c) and BPD4 (d) in DCM, measured with a streak camera in two spectral ranges (540-560 nm and 600-640 nm). Excitation - 355 nm.

All dyads demonstrate mono exponential decays with no changes in decay time over the whole emission range. The decay time of BPD1 (3.3 ns) corresponds to the CT-state. In case of BPD2 local excited (LE) and CT states are coupled and demonstrate similar decay time (4.6 ns). The decay time increases from 3.3 ns to 6.7 ns with increasing the number of alkyl group in BODIPY scaffold.

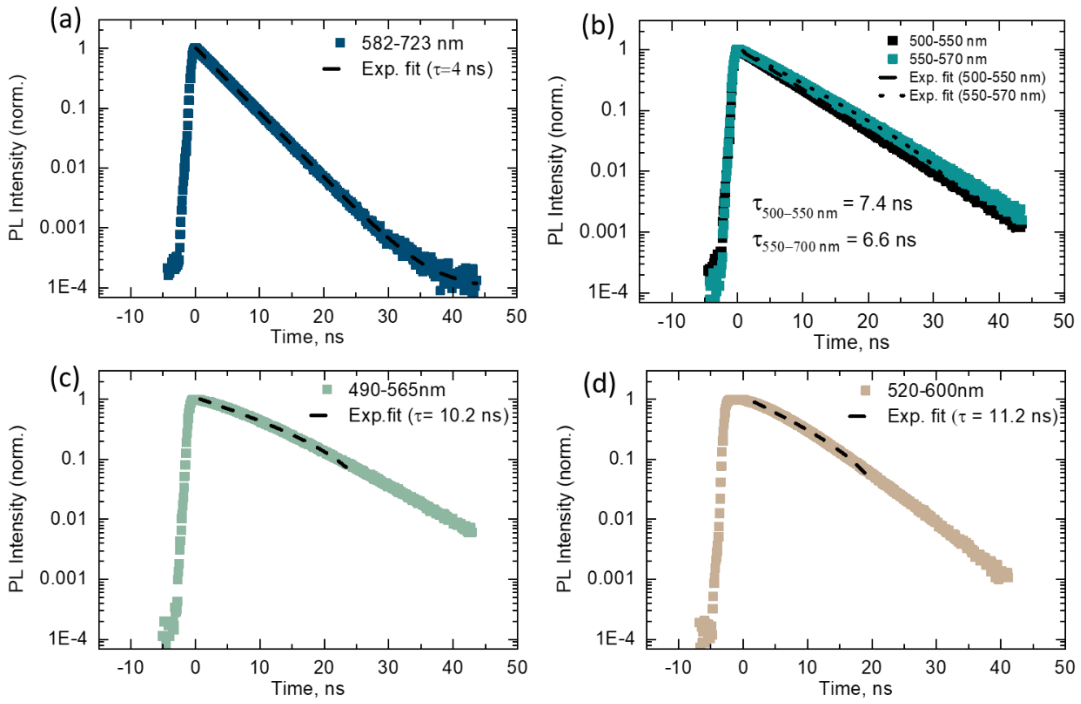

Figure S2. Photoluminescence decays of the BPD1 (a), BPD2 (b), BPD3 (c) and BPD4 (d) in THF, measured with a streak camera in different spectral ranges. Excitation - 355 nm.

The decay time of BPD1 (4 ns) corresponds to the CT-state. In case of BPD2 local excited (LE) and CT states demonstrate slightly different decay time (7.4 ns and 6.6 ns, respectively). The decay time increases from 4 ns to 11.2 ns with increasing the number of alkyl group in BODIPY scaffold.

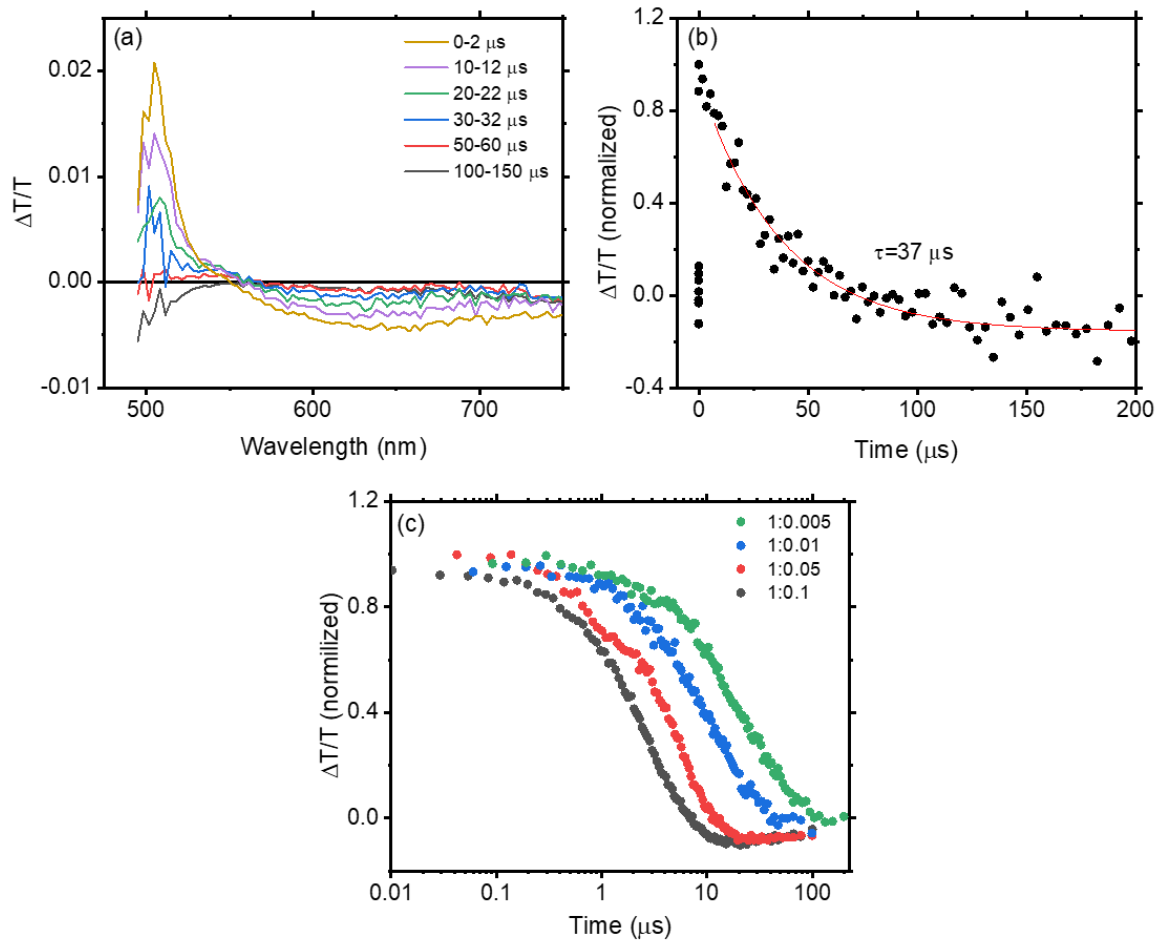

Figure S3. Transient absorption spectra of BPD1 in DCM (concentration 10^{-4} M); (b) decay of the peak at 520 nm corresponding to the ground state bleaching of the BODIPY unit. BPD1 in DCM (concentration 10^{-4} M); (c) decays of the peak at 505 nm corresponding to the ground state bleaching of the BODIPY unit at different ratio between BPD1 and perylene. BPD1 in DCM (concentration 10^{-4} M). Concentrations of perylene - 5×10^{-7}; 1×10^{-6}; 5×10^{-6}; 1×10^{-5} M.

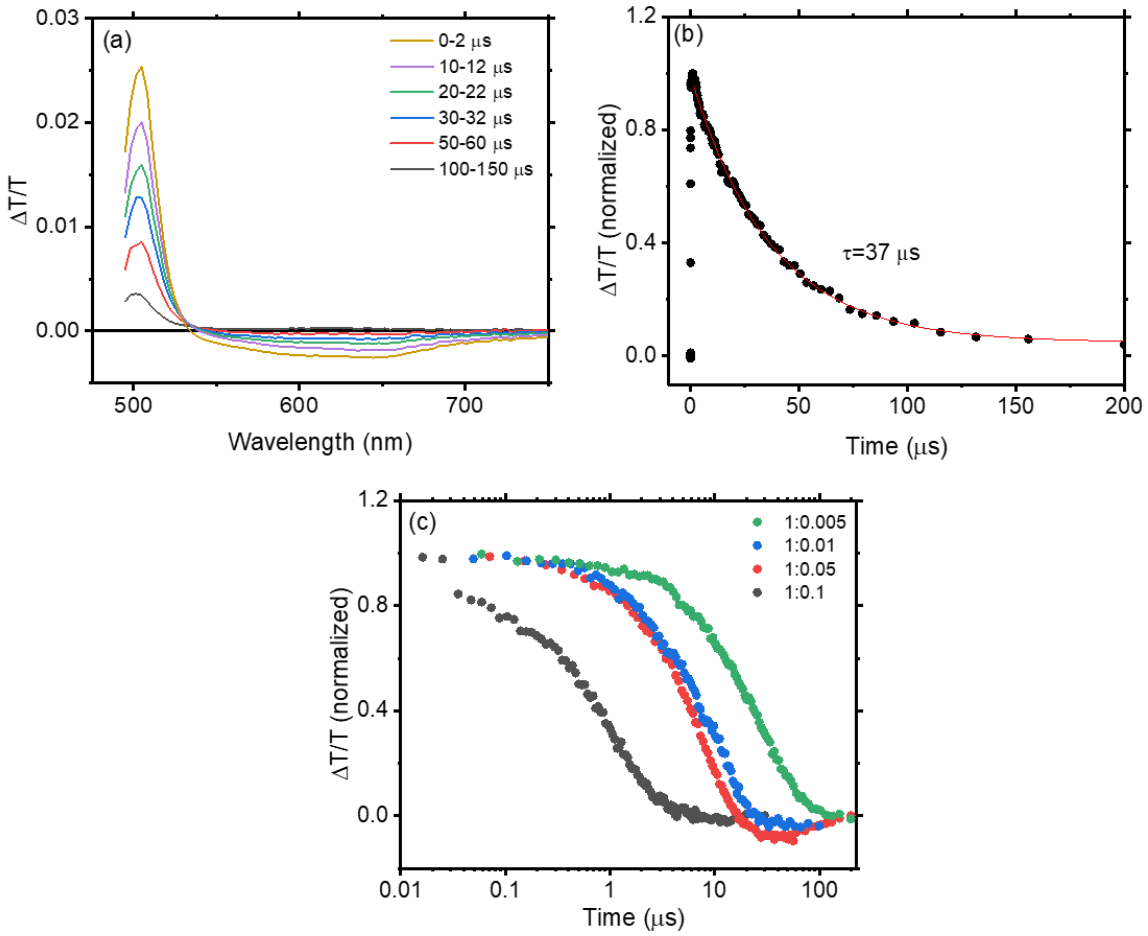

Figure S4. Transient absorption spectra of BPD1 in THF (concentration 10^{-4} M); (b) decay of the peak at 520 nm corresponding to the ground state bleaching of the BODIPY unit. BPD1 in THF (concentration 10^{-4} M); (c) decays of the peak at 505 nm corresponding to the ground state bleaching of the BODIPY unit at different ratio between BPD1 and perylene. BPD1 in THF (concentration 10^{-4} M). Concentrations of perylene - 5×10^{-7}; 1×10^{-6}; 5×10^{-6}; 1×10^{-5} M.

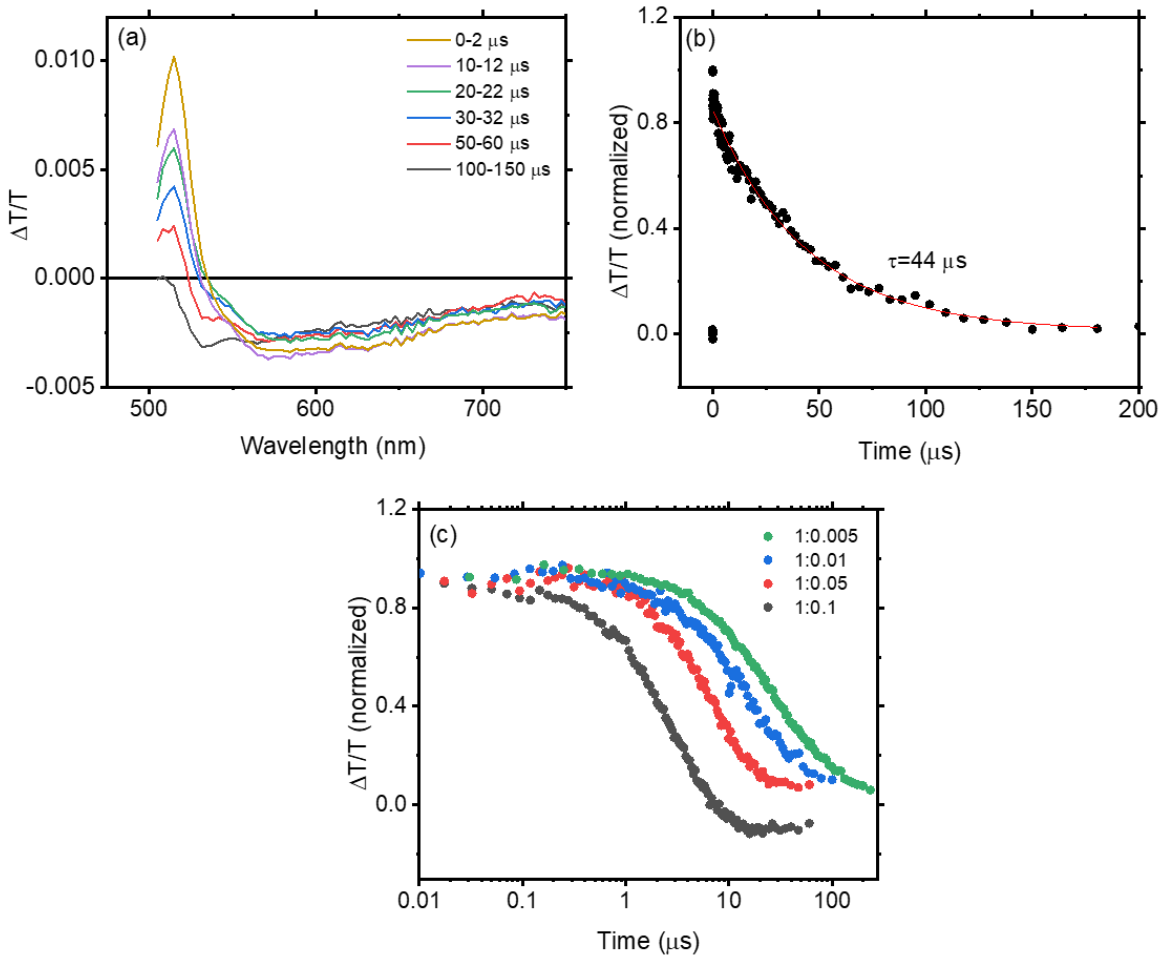

Figure S5. Transient absorption spectra of BPD2 in DCM (concentration 10^{-4} M); (b) decay of the peak at 520 nm corresponding to the ground state bleaching of the BODIPY unit. BPD2 in DCM (concentration 10^{-4} M); (c) decays of the peak at 505 nm corresponding to the ground state bleaching of the BODIPY unit at different ratio between BPD2 and perylene. BPD2 in DCM (concentration 10^{-4} M). Concentrations of perylene - 5×10^{-7}; 1×10^{-6}; 5×10^{-6}; 1×10^{-5} M.

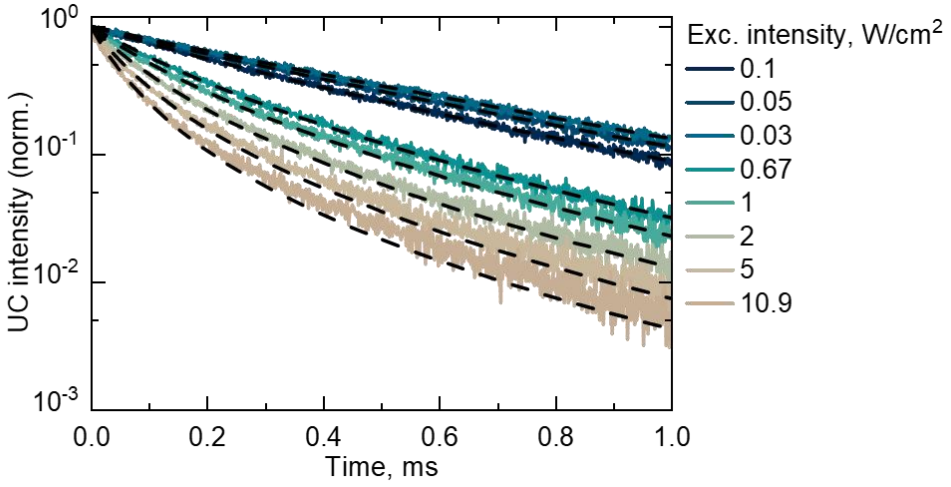

Figure S6. Normalized decays of UC PL of BPD1(C_{BPD1}= 1×10^{-5} M)-perylene mixture (1:10 molar ratio) under excitation with the 525 nm laser diode in deoxygenated DCM. Excitation intensities were measured in the steady-state excitation regime (without the laser modulation).

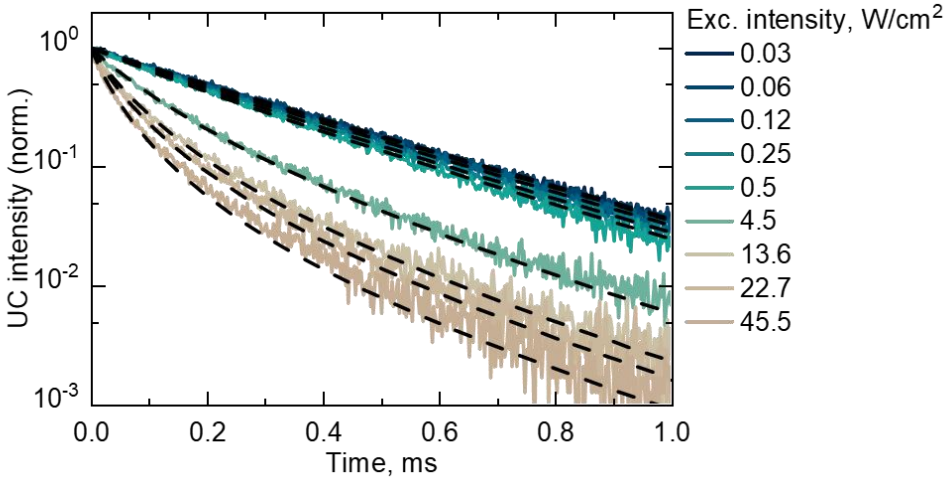

Figure S7. Normalized decays of UC PL of BPD1(C_{BPD1}= 1×10^{-5} M)-perylene mixture (1:10 molar ratio) under excitation with the 525 nm laser diode in deoxygenated THF. Excitation intensities were measured in the steady-state excitation regime (without the laser modulation).

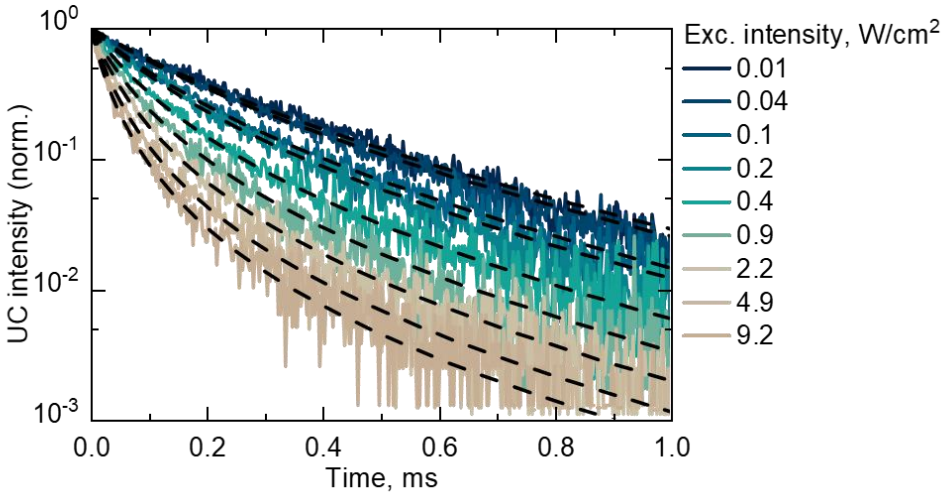

Figure S8. Normalized decays of UC PL of BPD2(C_{BPD2}= 1×10^{-5} M)-perylene mixture (1:10 molar ratio) under excitation with the 525 nm laser diode in deoxygenated DCM. Excitation intensities were measured in the steady-state excitation regime (without the laser modulation).

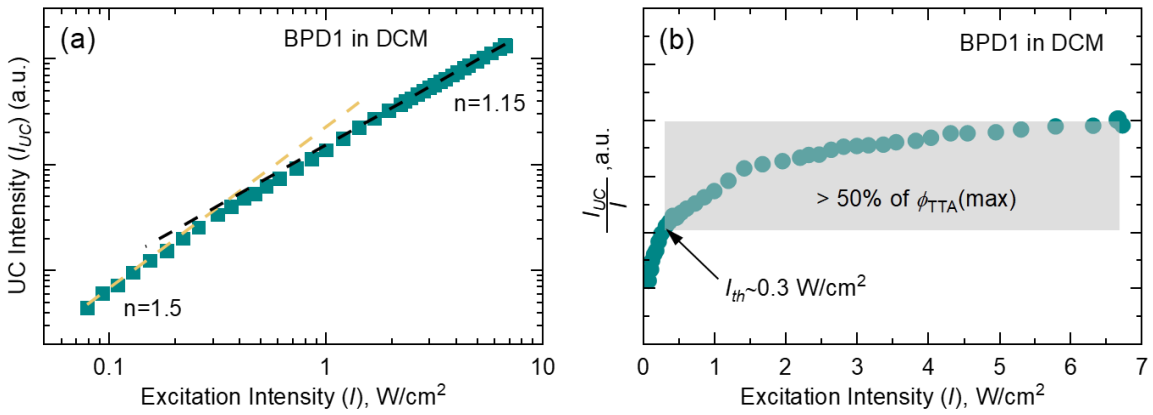

Figure S9. (a) A intensity dependence of UC luminescence of the BPD1(C_{BPD1}= 1×10^{-5} M)-perylene mixture (1:10 molar ratio) under excitation with the 498 nm laser diode in deoxygenated DCM; (b) Normalized UC luminescence (UC Intensity/Excitation Intensity) as a function of excitation intensity of the BPD1(C_{BPD1}= 1×10^{-5} M)-perylene mixture (1:10 molar ratio) under excitation with the 498 nm laser diode in deoxygenated DCM. It was assumed that values of ϕ_{UC} > 0.5×ϕ_{UC}^{max} can be relevant for practical applications. Thus, the value of excitation intensity corresponding to ϕ_{UC} ≈ 0.5×ϕ_{UC}^{max} was used as the I_{th} value.

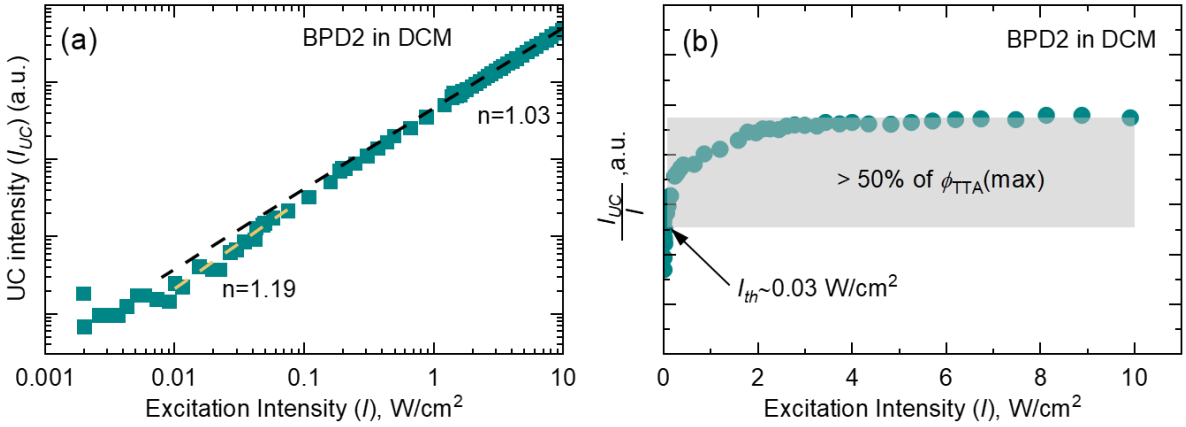

Figure S10. (a) A intensity dependence of UC PL of BPD2(C_{BPD1}= 1×10^{-5} M)-perylene mixture (1:10 molar ratio) under excitation with the 498 nm laser diode in deoxygenated DCM; (b) Normalized UC luminescence (UC Intensity/Excitation Intensity) as a function of excitation intensity of BPD2(C_{BPD2}= 1×10^{-5} M)-perylene mixture (1:10 molar ratio) under excitation with the 498 nm laser diode in deoxygenated DCM. It was assumed that values of ϕ_{UC} > 0.5×ϕ_{UC}^{max} can be relevant for practical applications. Thus, the value of excitation intensity corresponding to ϕ_{UC} ≈ 0.5×ϕ_{UC}^{max} was used as the I_{th} values.