

Abstract

Comparison of the Ultrafast Phenomena Between Eosin Y (EY) and Palladium (II) Octaethylporphyrin (PdOEP) as Sensitizers and Bis(terpyridine-4'-yl)terthiophene as an Annihilator on Thin Films for Optoelectronic Applications [†]

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This study presents a comparative investigation of ultrafast photophysical processes in thin films of eosin Y (EY) and palladium (II) octaethylporphyrin (PdOEP) as triplet sensitizers, combined with bis(terpyridine-4'-yl)terthiophene (T) as an annihilator. Thin films were fabricated by spin-coating on quartz substrates using chloroform (CHCl₃) and hexafluoroisopropanol (HFIP) solvents. Excitation wavelengths were chosen based on the absorption maxima of the individual and mixed components. Steady-state spectroscopy revealed distinct fluorescence and absorption features, with emission maxima ranging from 600 to 750 nm. Transient absorption spectroscopy (TAS) further confirmed efficient triplet energy transfer from both sensitizers to T, as evidenced by the characteristic ground-state bleaching (GSB) and excited-state absorption (ESA) signals spanning the 400–700 nm range. Global analysis of TAS data revealed multiexponential decay dynamics, with EY + T and PdOEP + T mixtures showing significantly extended triplet lifetimes compared to isolated components. Specifically, the EY + T system (1:4 ratio in HFIP, spin-coated) exhibited a rapid initial decay followed by a long-lived state exceeding 6 ns, while PdOEP + T (1:4 ratio in HFIP, spin-coated) displayed broader ESA bands related to triplet–triplet transitions. These results demonstrate the effectiveness of EY and PdOEP as sensitizers for triplet-state generation and energy transfer to T. The insights gained provide valuable guidance for optimizing triplet–triplet annihilation mechanisms in next-generation optoelectronic and photonic devices.



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