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Effect of temperature and exciton traps in endothermic singlet fission materials: The case of tetracene

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Abstract

We investigate two tetracene single crystals of different quality via time-, spectrally- and spatially-resolved photoluminescence (PL) measurements over a wide temperature range. A kinetic model provides insight into the underlying population transfer processes resulting from singlet fission and triplet recombination. Our results show that the temperature-dependency in the singlet fission process stems from the thermally activated dissociation of the correlated triplet pair state, leading to higher diffusion lengths at lower temperatures. Additionally, a significant impact of the sample quality on the diffusion length is observed and found to be caused by a combination of altered exciton trapping and dissociation dynamics.