Photophysical Investigation of Cyano-Substituted Terrylene Diimide Derivatives

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Two new terrylene diimide (TDI) chromophores with cyano substituents in the bay and core area (BCN-TDI and OCN-TDI, respectively) have been characterized by a wide range of techniques and their applicability for stimulated emission depletion (STED) microscopy has been tested. By cyano substitution an increase of the fluorescence quantum yield and a decrease of the non-radiative rate constant is achieved and attributed to a reduced charge-transfer character of the excited state due to a lower electron density of the TDI core. The single molecule photobleaching stability of BCN- and OCN-TDI is lower than a reference TDI without cyano substitution (C7-TDI), although less so for OCN-TDI. The photophysical properties of the excited singlet state are only slightly influenced by the cyano groups. The observed intense stimulated emission, the pump-dump-probe experiments and STED single molecule imaging indicate that STED experiments with the cyano substituted TDIs are possible. However, due to aggregation and more efficient photobleaching BCN- and OCN-TDI are less performant than the reference compound without cyano groups (C7-TDI). Bay substituted TDI are less suitable for STED microscopy.[1]