Sterically shielded thermally activated delayed fluorescence emitters with improved efficiency and stability

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Emitters with thermally activated delayed florescence (TADF) provide a cheaper alternative to achieve highly efficient and stable organic light-emitting diodes (OLEDs) without using phosphorescent noble-metal complexes. However, lifetimes of devices based on TADF emitters are still far from satisfactory until now. Here, we demonstrate that by protecting the TADF luminophore with steric bulky groups such as tert-butyl, both efficiencies and stabilities can be improved simultaneously. The large steric hindrance of substituents would increase the intermolecular separation and reduce the triplet-polaron annihilation, which is responsible for the intrinsic degradation of TADF OLEDs. Consequently, lifetime of a sky-blue device with the sterically shielded emitter is improved by 4.6 folds compared with the pristine one. An extrapolated half lifetime of 12873 h at 100 cd/m^2 is achieved for a sky-blue device with a high peak external quantum efficiency of 20.6%. This strategy may shed light on the design of efficient and stable TADF emitters.