Multiple Resonance TADF Emitters with D-A Typed Structures

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Abstract

Highly twisted electron donor (D)-electron acceptor (A)-type thermally activated delayed fluorescence (TADF) emitters can achieve high efficiency while suffering from serious structural relaxations and broad emissions. Multiple resonance (MR)-type TADF emitters can realize narrow emission. However, until now, only a few efficient MR-emitting cores are reported and custom tuning of their emission color remains a major challenge in their wider applications.

By combining the conventional TADF and MR-TADF designs, we demonstrate that color tuning and narrowing the spectral width of conventional TADF emission can be easily achieved simultaneously. We select carbonyl (C=O)/N-based MR cores as backbones and attach them with D segments of different electron-donating abilities and numbers to obtain D-A typed TADF emitters. Emissions from sky blue to green and orange-red can be obtained while maintaining the narrow emission of the original MR cores. We also clarify the importance of excited state alignments of such MR-based D-A molecules in determining their preferring characteristics. Our work demonstrates when introducing D-A typed structures, features and alignments of molecular excited states determine ultimate material properties. This could help to develop high efficiency and high color purity TADF emitters toward long wavelength range.