

SHORT-RANGE CHARGE TRANSFER AND BIPOLAR CHARGE TRANSPORT IN DIBENZO{A,C}IMIDAZOPHENAZINE-BASED EMITTER WITH MR-TADF FOR SOLUTION-PROCESSABLE HYPERFLUORESCENT OLEDs

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We present a novel approach to the emitters exhibiting multiple resonance-induced thermally activated delayed fluorescence (MR-TADF), addressing the challenges of the synthesis of pure-color emitters with efficient triplet harvesting. Building upon our recently reported acceptor, 11,13-dihydro-12H-dibenzo[a,c]imidazo[4,5-i]phenazin-12-one (BIPO) with a small modification, we developed a new derivative, which integrates the BIPO core with a 5H-dibenzo[b,f]azepine donor unit. The synthesized compounds exhibit highly efficient narrowband photoluminescence (PL) with full width at half-maximum (FWHM) as low as 35 nm and photoluminescence quantum yields of their solutions reaching more than 75% and solid matrix approaching 100%. Notably, the synthesized compound demonstrates short-range charge-transfer emission, enabling efficient MR-TADF despite a relatively large experimental singlet-triplet energy gap. The MR-TADF mechanism was thoroughly investigated through temperature-dependent steady-state luminescence spectroscopy, time-resolved luminescence spectroscopy, and theoretical calculations, revealing the involvement of higher-lying triplet states that facilitate reverse intersystem crossing. Time-of-flight studies of the solid films of the newly synthesized compound underscore the bipolar charge transport properties. Hole and electron mobilities exceeded $1 \times 10^{-4} \text{ cm}^2/\text{V}\cdot\text{s}$ under high electric fields. Furthermore, the newly synthesized emitter performs well in solution-processed hyperfluorescent organic light-emitting diodes, achieving external quantum efficiency of 5.7% and sky-blue emission with a narrow FWHM of 53 nm. These findings highlight the synthesized derivative of BIPO and 5H-dibenzo[b,f]azepine as a promising candidate for the next-generation pure-color, energy-efficient OLEDs.