Electronic Supplementary Material (ESI) for Journal of Materials Chemistry C.

Abnormal current dependence of high-level reverse intersystem crossing induced by Dexter energy transfer from hole-transporting layer

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Supporting Table S1

Table S1 Energy levels and triplet energies of the used organic functional materials

Abbreviation	HOMO (eV)	LUMO (eV)	T_1 (eV)	T_2 (eV)
m-MTDATA[1]	-5.1	-2.0	2.70	-
mCP[2,3]	-5.8	-2.3	2.93	-
BCP[4,5]	-6.7	-3.2	2.6	-
Rubrene[6,7,8]	-5.4	-3.2	1.14	2.40

Supporting Text S1

Generally speaking, the simplified kinetic scheme for the SF process[9] in rubrene can be described as $S_1+S_0 \rightleftharpoons {}^1(TT) \rightleftharpoons T_1+T_1$ because S_1 and $2T_1$ are nearly resonant in energy, where $^1(TT)$ represents an intermediate triplet pair. The $^1(TT)$ includes nine substates with equal probability, but the rate (k_{fiss}) of singlet fission is only determined by the number (N_S) of $^1(TT)$ carrying singlet character. When the applied field B equals to zero, three of the nine substates for $^1(TT)$ states possess singlet character (i.e., $N_S=3$). Within low magnetic field range ($|B|<20$ mT), the Zeeman energy induced by the magnetic field ($\approx g\mu_B B$) is less than zero-field splitting energy, and N_S rises with increasing B. Thus, k_{fiss} increases gradually and the MEL reduces slightly with B. When the field B has the same energy as the zero-field splitting, N_S increases to nine (i.e., $N_S=9$) and the MEL reaches to a minimum. At 20 mT$\le |B| \le$41 mT, N_S starts to decrease and the MEL increases and reaches to the zero-field value at 41 mT. When B is markedly larger than the zero-field splitting, N_S finally reduces to 2 and k_{fiss} decreases pronouncedly, leading to tremendously enhanced MEL in our rubrene-based OLEDs.

Supporting Figures

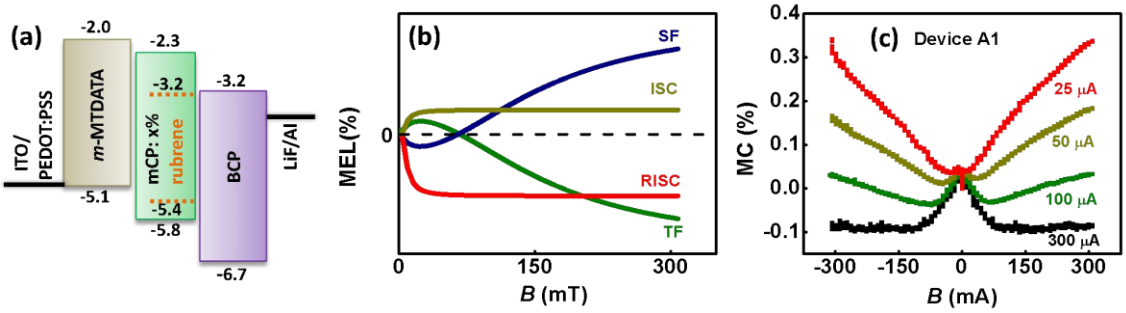

Fig. S1 (a) Energy level alignments of device A. (b) The fingerprint MEL curves corresponding different microscopic mechanisms. (c) Current-dependent MC responses for device A1 at room temperature.

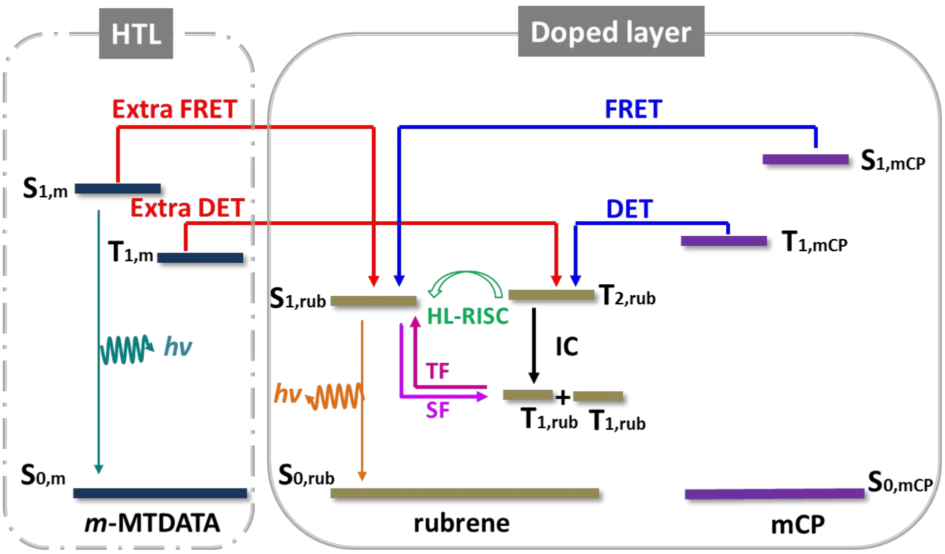

Fig. S2 The schematic of energy transfer and microscopic mechanism in device A1.

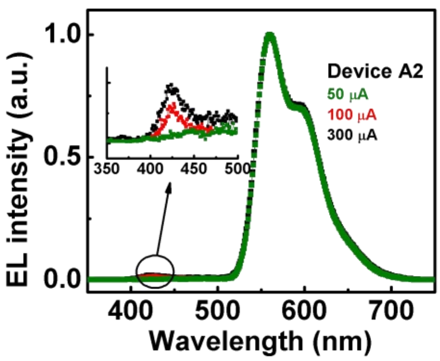

Fig. S3 Current-dependent EL spectra of device A2.

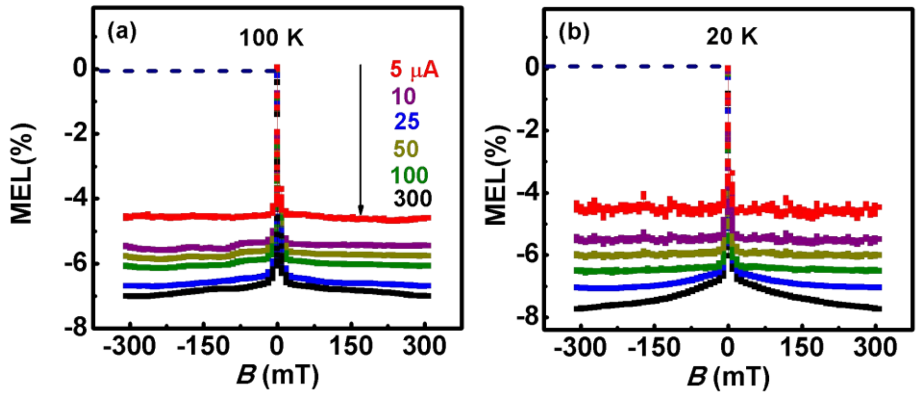

Fig. S4 Current-dependent MEL responses of device A1 at low temperatures. (a) 100 K. (b) 20 K.

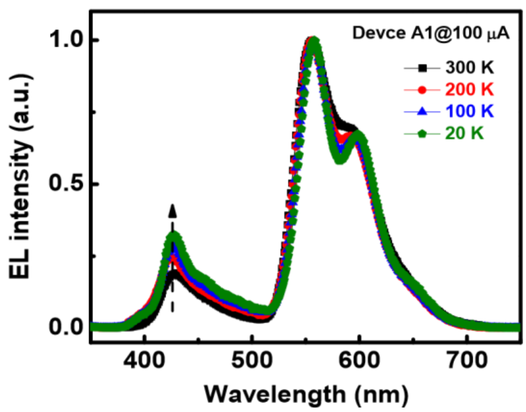

Fig. S5 Temperature-dependent EL spectra for device A1 at 100 A.

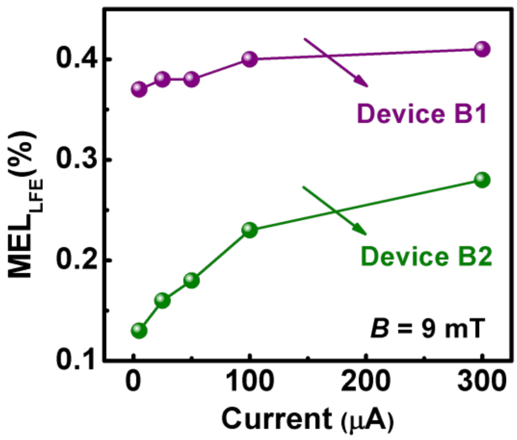

Fig. S6 MEL_{LFE} values as a function of injection current for devices B1 and B2.

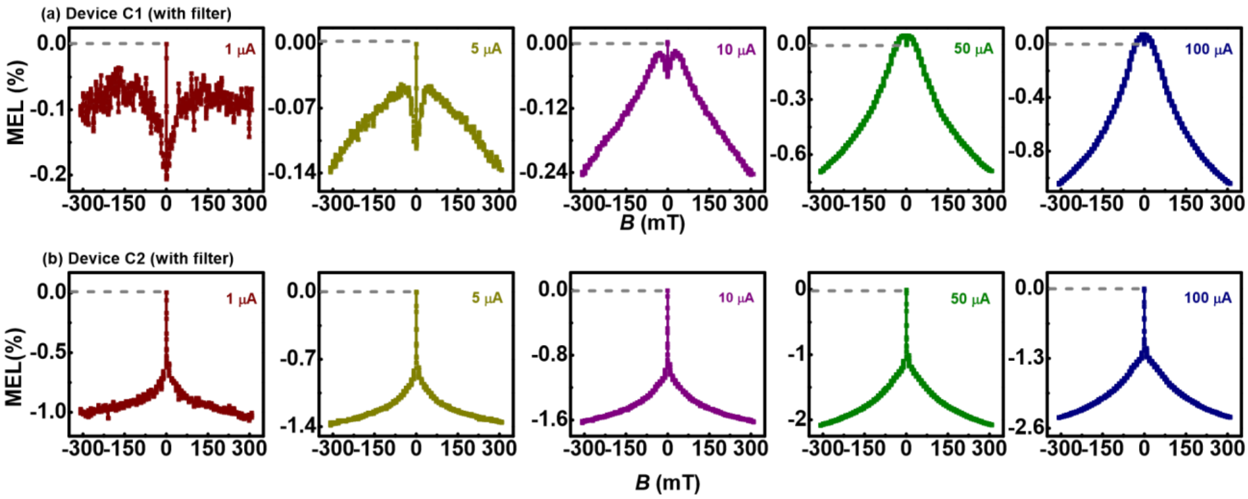

Fig. S7 Current-dependent MEL curves for devices measured by adding filter with 520 nm.

(a) Device C1. (b) Device C2.

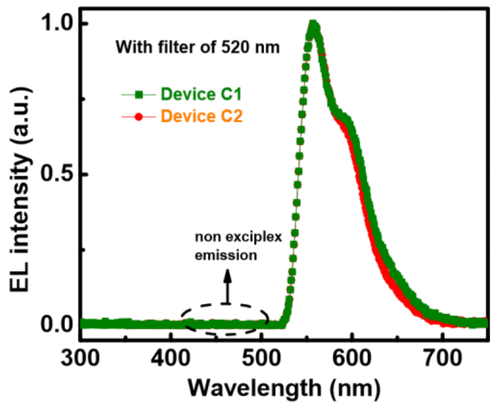

Fig. S8 Normalized EL spectra for devices C1 and C2 measured by adding filter with 520 nm.

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