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

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>HOMO (eV)</th>
<th>LUMO (eV)</th>
<th>T₁ (eV)</th>
<th>T₂ (eV)</th>
</tr>
</thead>
<tbody>
<tr>
<td>m-MTDATA¹</td>
<td>-5.1</td>
<td>-2.0</td>
<td>2.70</td>
<td>-</td>
</tr>
<tr>
<td>mCP₂,₃</td>
<td>-5.8</td>
<td>-2.3</td>
<td>2.93</td>
<td>-</td>
</tr>
<tr>
<td>BCP₄,₅</td>
<td>-6.7</td>
<td>-3.2</td>
<td>2.6</td>
<td>-</td>
</tr>
<tr>
<td>Rubrene₆,₇,₈</td>
<td>-5.4</td>
<td>-3.2</td>
<td>1.14</td>
<td>2.40</td>
</tr>
</tbody>
</table>

Supporting Text S1

Generally speaking, the simplified kinetic scheme for the SF process⁹ in rubrene can be described as S₁+S₀ ⇌¹(TT) ⇌T₁+T₁ because S₁ and 2T₁ 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 (kₕiss) of singlet fission is only determined by the number (Nₕ) 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., Nₕ=3). Within low magnetic field range (|B|<20 mT), the Zeeman energy induced by the magnetic field (≈gₑB) is less than zero-field splitting energy, and Nₕ rises with increasing B. Thus, kₕiss increases gradually and the MEL reduces slightly with B. When the field B has the same energy as the zero-field splitting, Nₕ increases to nine (i.e., Nₕ=9) and the MEL reaches to a minimum. At 20 mT≤|B|≤41 mT, Nₕ 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, Nₕ finally reduces to 2 and kₕiss 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 µA.

**Fig. S6** $\text{MEL}_{\text{LFE}}$ 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.

**References**


5 S. I. Yoo, J. A. Yoon, N. H. Kim, J. W. Kim, H. W. Lee, Y. K. Kim, G. F. He and W. Y. Kim, 