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

Supporting Information

Color regulation for Eu(tta)$_3$phen/E7 composites by interaction between Eu(III) complexes and liquid crystals

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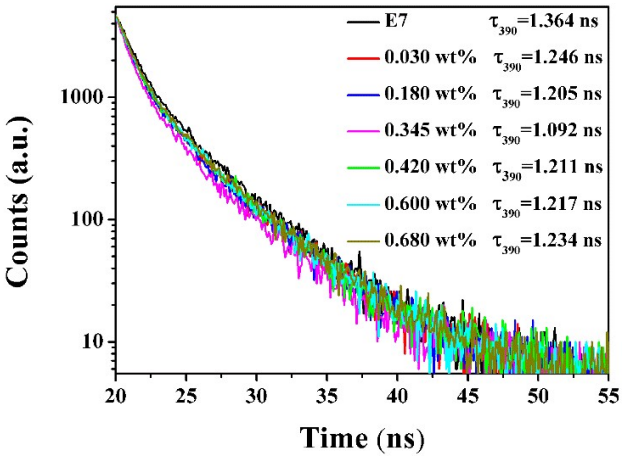

Fig. S1. Decay curves for the luminescence of the pure E7 and Eu(tta)$_3$phen doped E7 with different concentrations (monitored at 390 nm), both the samples obey the double-exponential function.

The changes of E7 lifetimes after the presence of Eu(tta)$_3$phen complexes indicate that Förster-type energy transfer exists between them. The efficiency of Förster-type energy transfer (η_F) can be obtained according to equation:[1]

$$\eta_F = 1 - \frac{\tau_S}{\tau_{S0}}. \quad (1)$$

Where τ_{S0} is the lifetime values of E7 in the absence of Eu(tta)$_3$phen, τ_S is the lifetime values of E7 in the presence of Eu(tta)$_3$phen. The results are shown in Fig. S2 (a). Since η_F is always less than the total energy transfer efficiency,

the radiative reabsorption energy transfer mechanism is also accompanied by the process of energy transfer. The efficiency of the radiative reabsorption energy transfer (η_R) can be obtained according to equation:[1]

$$\eta_R = \eta - \eta_F . \tag{2}$$

Where η is the total energy transfer efficiency.

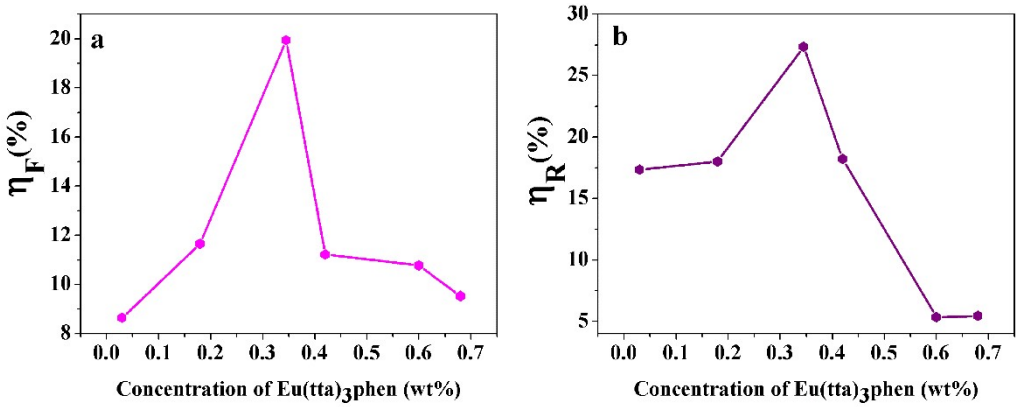

Fig. S2. (a) Efficiency of Förster-type energy transfer for Eu(tta)$_3$phen/E7 composites with different concentrations, (b) efficiency of radiative reabsorption energy transfer for Eu(tta)$_3$phen/E7 composites with different concentrations.

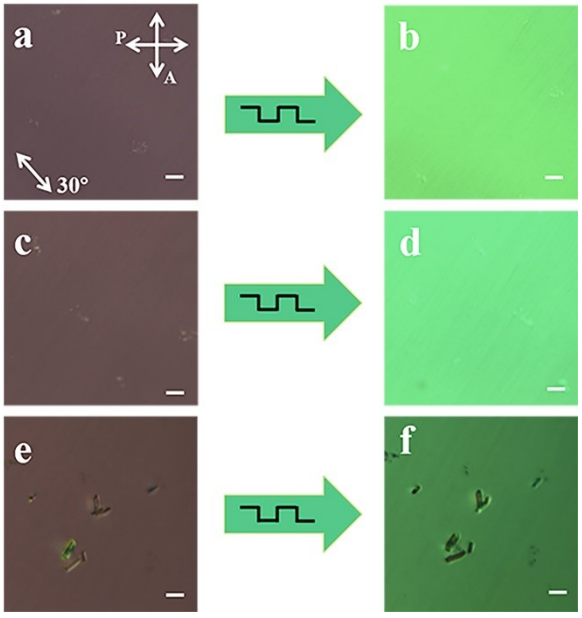

Fig. S3. POM images of the E7 (a, b) and Eu(tta)$_3$phen/E7 composites (c, d, e, f) in LC cells, crossed polarizers, 20×. The concentration is 0.345 (c and d) and 0.680 wt% (e and f), respectively. The square wave voltage was applied across the LC cells (b, d, f) or not (a, c, e). The angle between the aligning layer direction and the polarization direction was about 30°. A, analyzer; P, polarizer. The scale bar is 20 μm.

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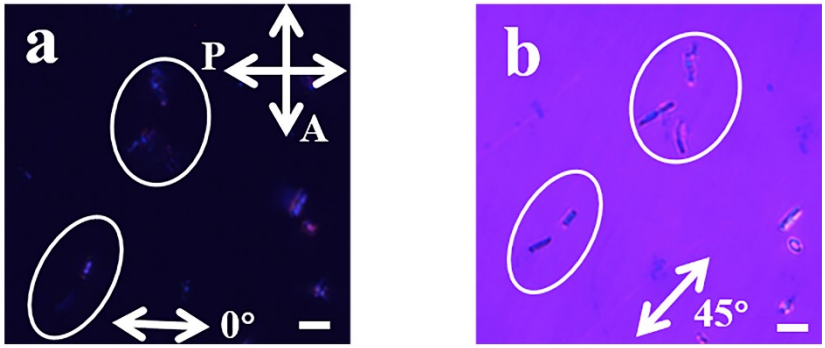

Fig. S4. POM images of the Eu(tta)$_3$phen/E7 composites, crossed polarizers, 20×. The angle between the aligning layer direction and the polarization direction was 0° (a) and 45° (b), respectively. The concentration is 0.680 wt%. A, analyzer; P, polarizer. The scale bar is 20 μm.

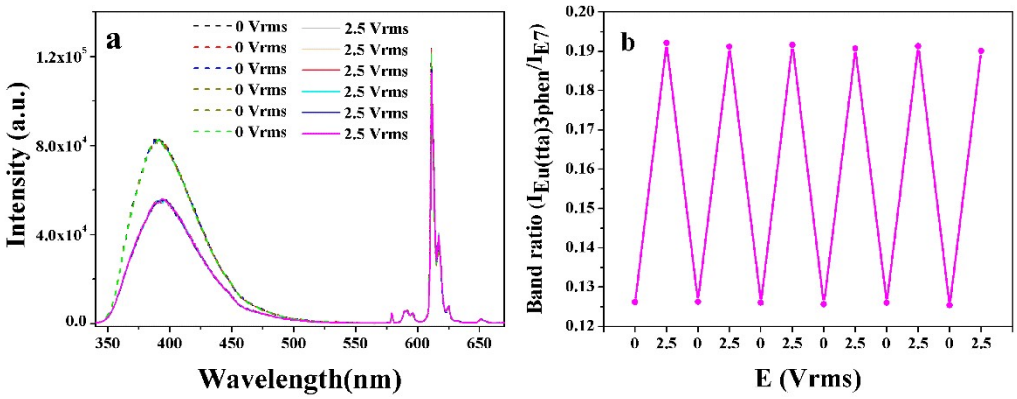

Fig. S5. (a) Emission spectra of Eu(tta)$_3$phen/E7 composites, measured cyclically under the condition of open circuit (dashed line) and applying a voltage of 2.5 Vrms (solid line), λ_{ex}=337 nm, (b) changes in the ratio of integral intensity of Eu(tta)$_3$phen to E7 under the condition of open circuit and applying a voltage of 2.5 Vrms.

References

1. C. J. Li, X. F. Liu and J. R. Qiu, *Physical Chemistry Chemical Physics*, 2018, **20**, 26513.