Electronic Supplementary Material (ESI) for Soft Matter.

One Platform Solid Multicolor Emission of Terthiophene Compound Controlled by Mixed Self-Assembly

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Supporting Information

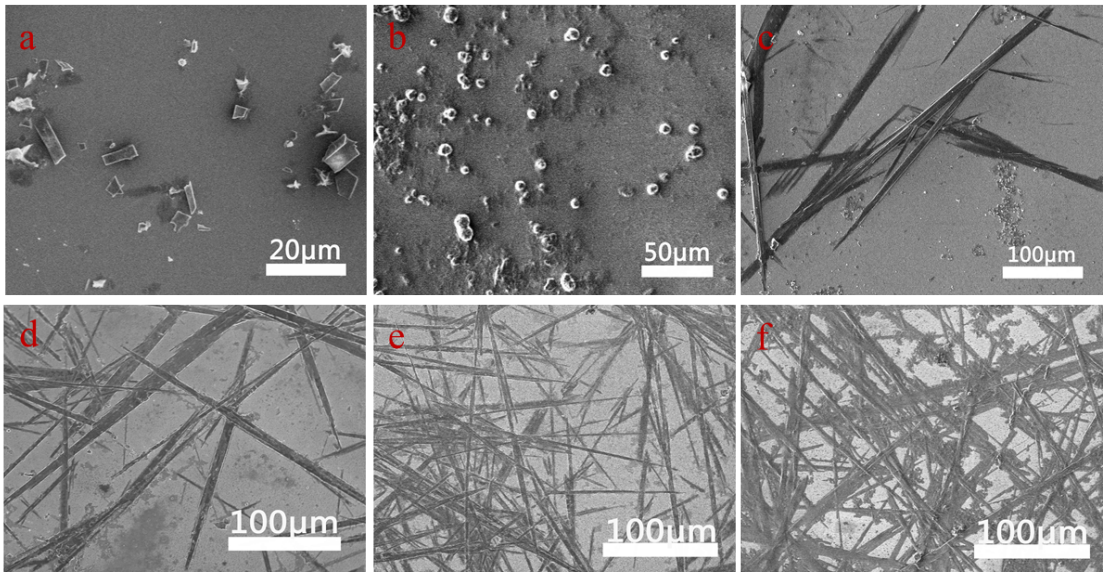


Fig.S1 SEM images of the self-assemble structures of 0.10 mM TTC4L in the presence of different ratios of DEAB, (a) 1:0, (b) 2:1, (c) 1:1, (d) 1:5, (e) 1:10 and (f) 1:20.

Fig.S1 displays the SEM images of the precipitates of TTC4L **(**0.10 mM**)** in the presence of different ratios of TTC4L and DEAB. Clearly, in the absence of DEAB, TTC4L self-assemble into plate-like structures, whereas microspheres and needle-like crystals were formed with the ratio of TTC4L and DEAB increasing. The microspheres exist in a very narrow ratio range, and were found predominant in the presence of 2:1. At this state, the charge ratio between TTC4L and DEAB is roughly 2:1. As the charge ratio increases in the range of 1:1~1:20, needles become dominating. Both the width and the length of the needles decreased with the amount of DEAB increasing.

Table S1. The photophysical data of the self-assemble structures of TTC4L in the absence and presence of DEAB.

TTC4L-DEAB [mM]	UV-Vis λ_{max} [nm]	FL λ_{max} [nm]	$< \tau >$ [a] [ns]	Φ(%)[b]
0.10-0.00	346	477	1.22	6.99
0.10-0.05	357	442	0.88	4.06
0.10-0.10	361	442	0.8	2.98

a) An apparent decay time constant < τ > was determined by using the relation $\langle\tau\rangle = \sum_{i=1}^{n} a_i \times \tau_i \Big/ \sum_{i=1}^{n} a_i$ (n = 2 ~ 3), where τ_i and a_i, respectively, represent the individual exponential decay time constant and the corresponding pre-exponential factor;[1] b) Φ is measured by calibrated integrating sphere.

The fluorescence quantum yields of TTC4L were 0.07, 0.04 and 0.03, for the green-emission plates, yellow-green spheres and blue-emissive needle-like crystals, respectively (see Table S1). The fluorescence decays of green-emission plates, yellow-green spheres and blue-emissive needle-like crystals were measured and the corresponding average fluorescence lifetimes were fitted to be 1.22 ns, 0.88 ns and 0.80 ns, respectively. With the concentration of DEAB increasing, the quantum yield and average fluorescence lifetime of TTC4L are decreased. These properties are reasonable because TTC4L exhibits normal fluorescent features that crystallization usually decreases the emission efficiency.[2, 3]

Table S2. The fitting parameter χ^2 of 1, 2 and 3 exponential.

TTC4L/DEAB	1 exponential	2 exponential	3 exponential
1:0	3.25	1.87	1.24
2:1	2.92	1.44	1.12
1:1	1.47	1.66	1.13
1:5	1.61	1.33	1.18
1:10	2.34	1.39	1.28
1:20	1.01	1.34	1.08

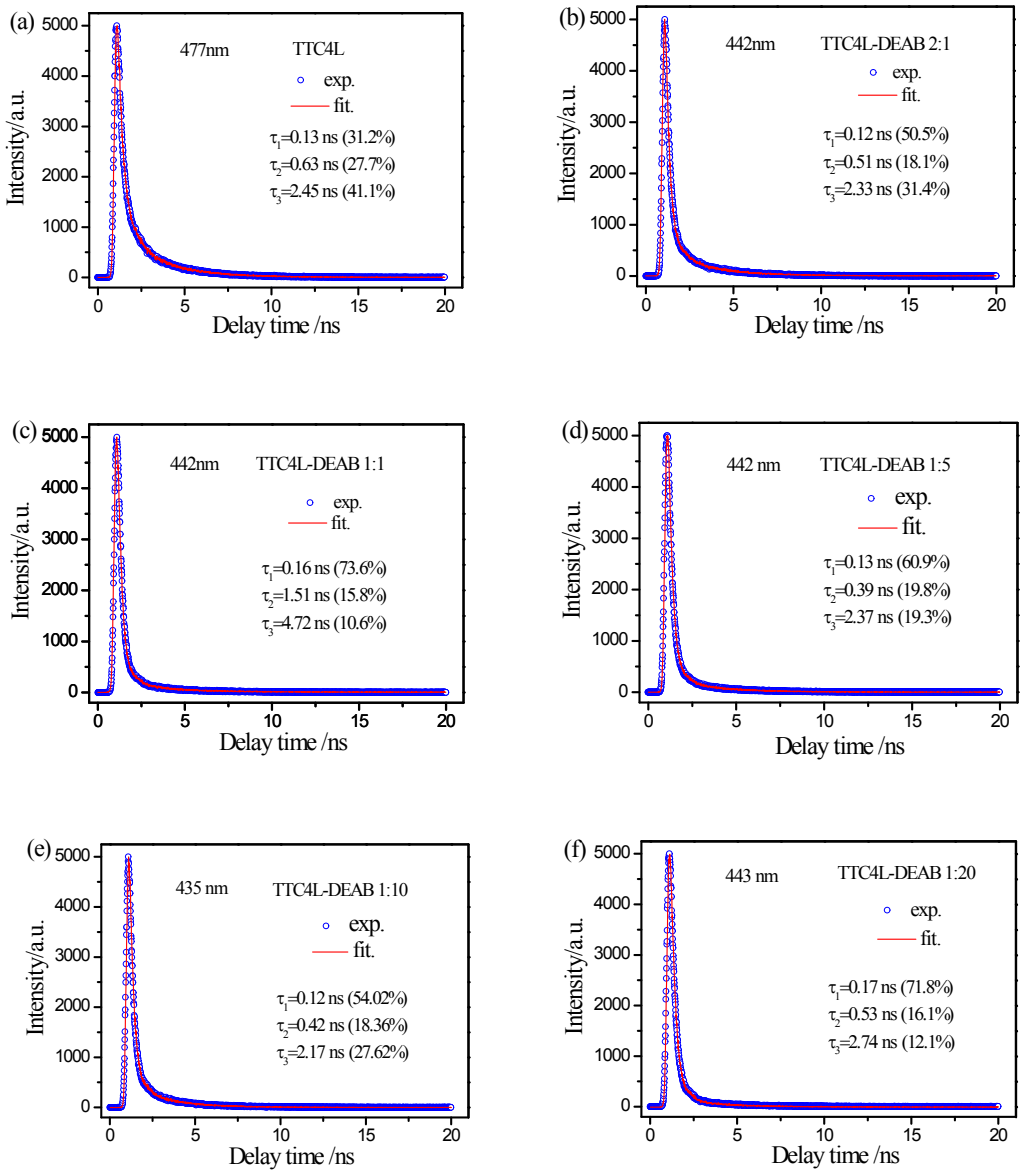
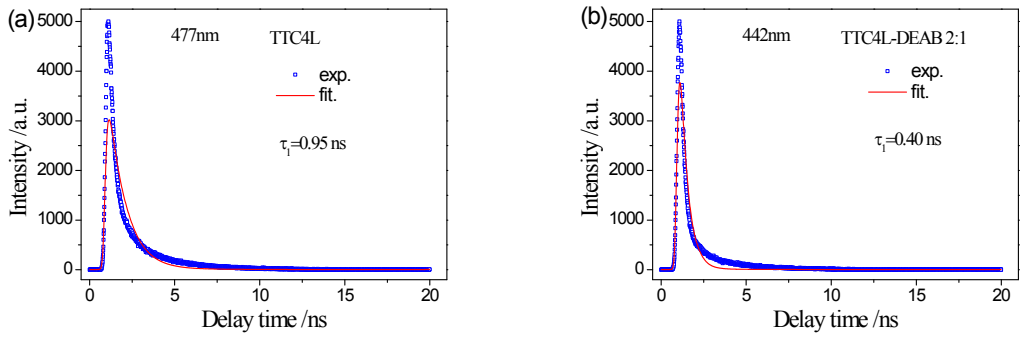


Fig.S2. 3 Exponential fluorescence lifetime fitting curves of assemblies of 0.10 mM TTC4L in the presence of different ratios of DEAB (a) 1:0, (b) 2:1, (c) 1:1, (d) 1:5, (e) 1:10 and (f) 1:20.



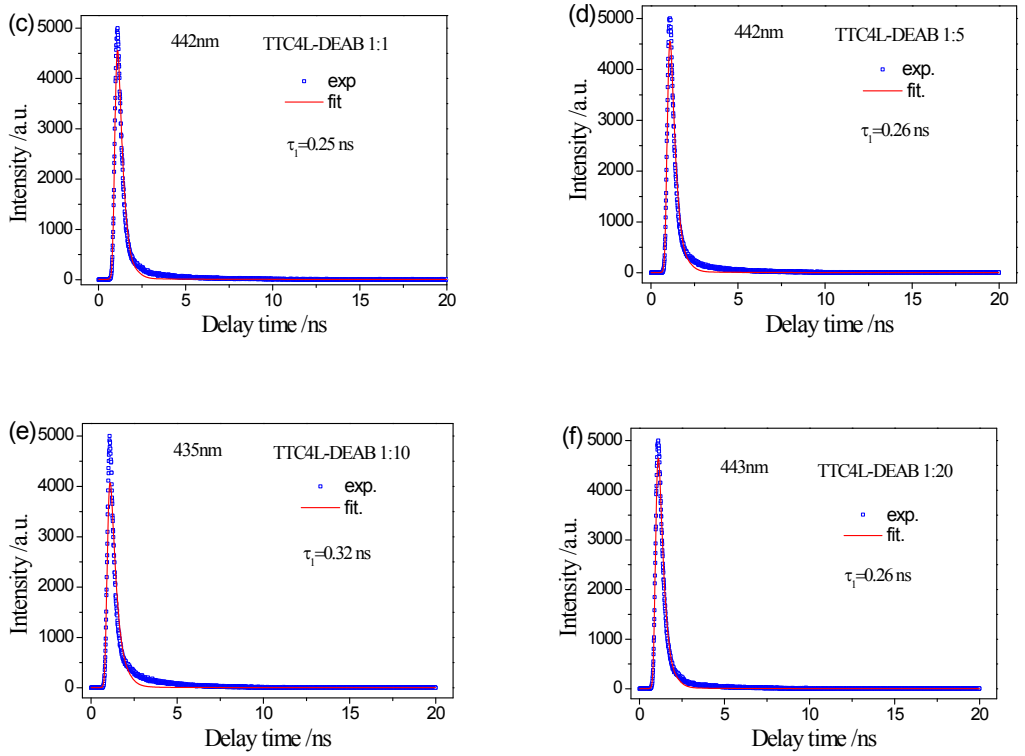
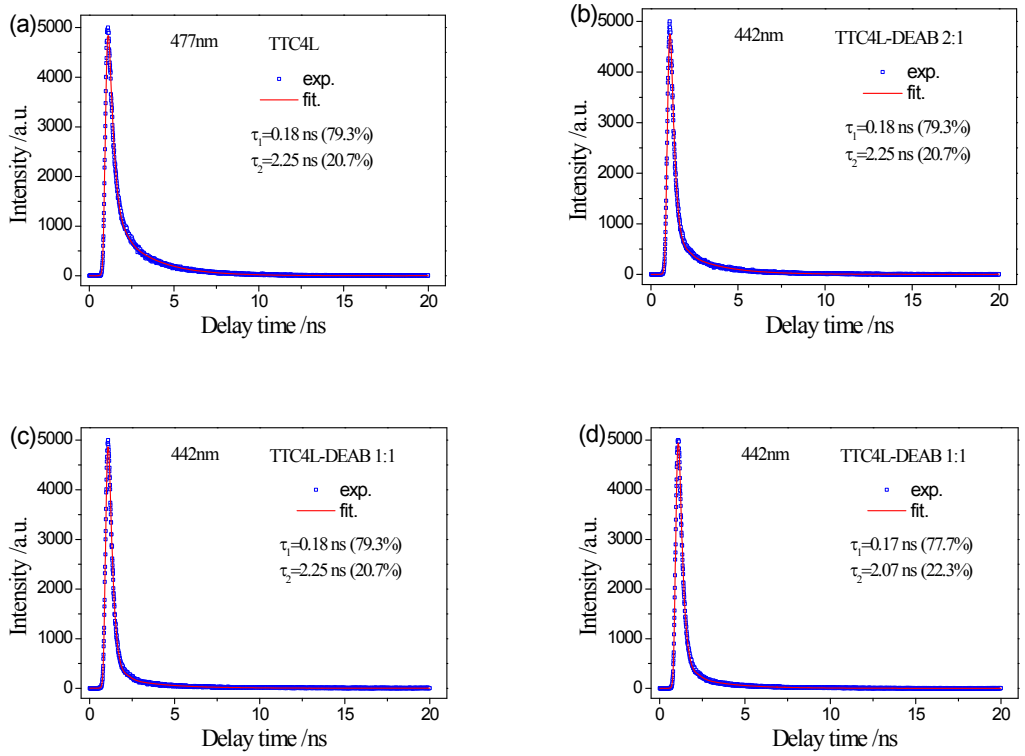


Fig.S3. 1 Exponential fluorescence lifetime fitting curves of assemblies of 0.10 mM TTC4L in the different ratios of DEAB of 1 exponential (a) 1:0, (b) 2:1, (c) 1:1, (d) 1:5, (e) 1:10 and (f) 1:20.



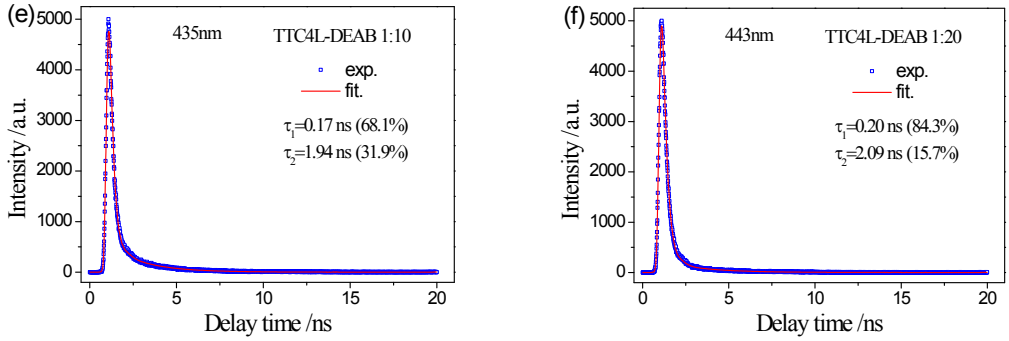


Fig.S4. 2 Exponential fluorescence lifetime fitting curves of assemblies of 0.10 mM TTC4L in the different ratios of DEAB of 2 exponential (a) 1:0, (b) 2:1, (c) 1:1, (d) 1:5, (e) 1:10 and (f) 1:20.

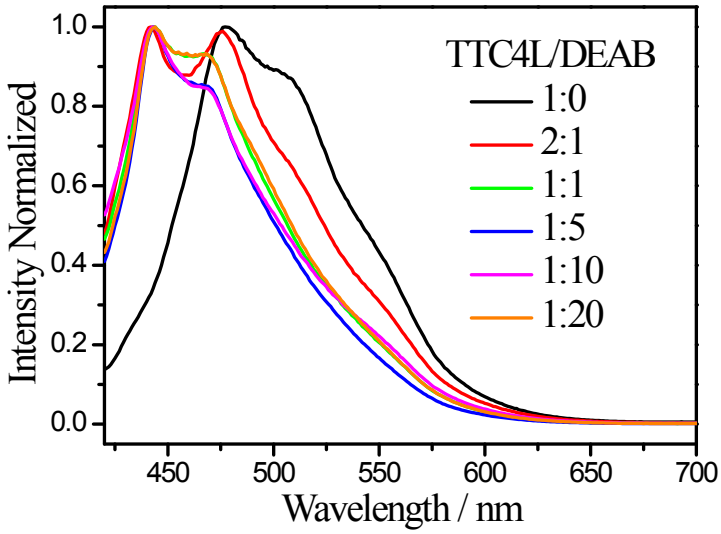


Fig.S5. The normalized fluorescence spectra (irradiated at 405 nm) assemblies of 0.10 mM TTC4L obtained at different ratios of TTC4L and DEAB.

From the solid fluorescence spectroscopy (Fig.S3), we can see the fraction of TTC4L in the form of monomer (437nm)[4-6] increases and the fraction in the aggregate form (475nm)[7-9] decreases with the increase ratio of TTC4L/DEAB. Corresponding to the variation of the fraction of TTC4L in different states, three lifetimes obtained for the different emission assemblies can be ascribed. The shorter lifetime can be ascribed to the monomers of TTC4L, whereas the mediate one originates from the aggregated TTC4L molecules.[10, 11] And the longest one is ascribed to the excimers.

Reference

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