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Supplementary Information

Blending conjugated polymers without phase separation for fluorescent colour tuning of polymeric materials through FRET

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1. General

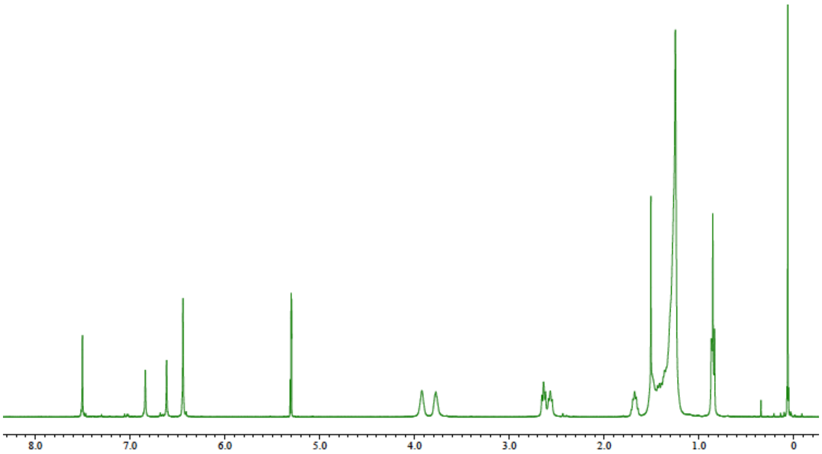
Air and water sensitive synthetic manipulations were performed under an argon atmosphere using standard Schlenk techniques. All chemicals were purchased from Aldrich, TCI, Kanto Chemical, or Wako and used as received without further purification. NMR spectra were recorded on a JEOL ECS-400 (400 MHz) spectrometer by using tetramethylsilane (0 ppm for ^{1}H NMR) or residual $CHCl_3$ (77 ppm for ^{13}C NMR) as an internal standard. Gel permeation chromatography was performed in THF solution using a TOSHO GPC system (HLC-8320GPC EcoSEC) equipped with two TSK gel Super-Multipore HZ-M columns and a UV detector (254 nm). The molecular weight (M_n) and polydispersity index (PDI) of the polymer samples were calculated on the basis of a polystyrene calibration. Absorption and fluorescence spectra were recorded on a JASCO V-630 spectrophotometer and a JASCO FP-8500 spectrofluorometer, respectively, in chloroform solution at room temperature (298 K) in a quartz cuvette of 1 cm path length. Fluorescence quantum yield was recorded on a Hamamatsu absolute PL quantum yield spectrometer C11347. Spin coating was done on an OSHIGANE SC-300 instrument.

2. Synthesis of the polymers

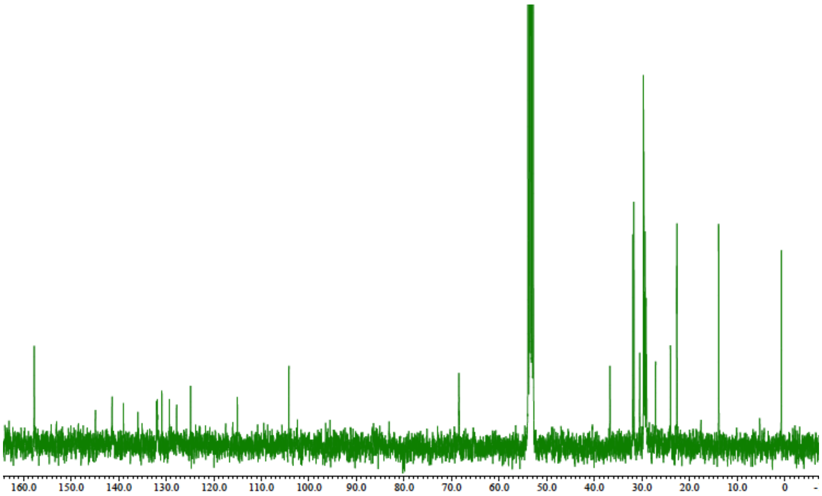
The polymer **A1** was synthesized by following the previous reported method.[6]

Characterization of Polymer A1:

^{1}H NMR (CD_2Cl_2, 400 MHz, TMS, 298 K, see below): δ 0.83-0.87 (m, 12H), 1.25-1.40 (m, 76H), 1.66-1.69 (m, 4H), 2.57 (t, J = 7.6 Hz, 4H), 2.64 (t, J = 7.6 Hz, 4H), 3.77 (m, 4H), 3.92 (m, 4H), 6.44 (s, 4H), 6.61 (s, 2H), 6.84 (s, 2H), 7.50 (s, 2H). ^{13}C NMR (CD_2Cl_2, 100 MHz, TMS, 298 K, see below): δ 13.90, 22.65, 22.68, 24.01, 27.17, 29.04, 29.18, 29.36, 29.41, 29.51, 29.66, 29.71, 30.49, 31.73, 31.92, 36.74, 68.49, 104.22, 115.04, 124.86, 129.31, 130.91, 131.86, 132.00, 141.36, 157.72. M_n = 19.6K, M_w = 36.5K against polystyrene standard.



^{1}H NMR spectrum of **A1**



^{13}C NMR spectrum of **A1**

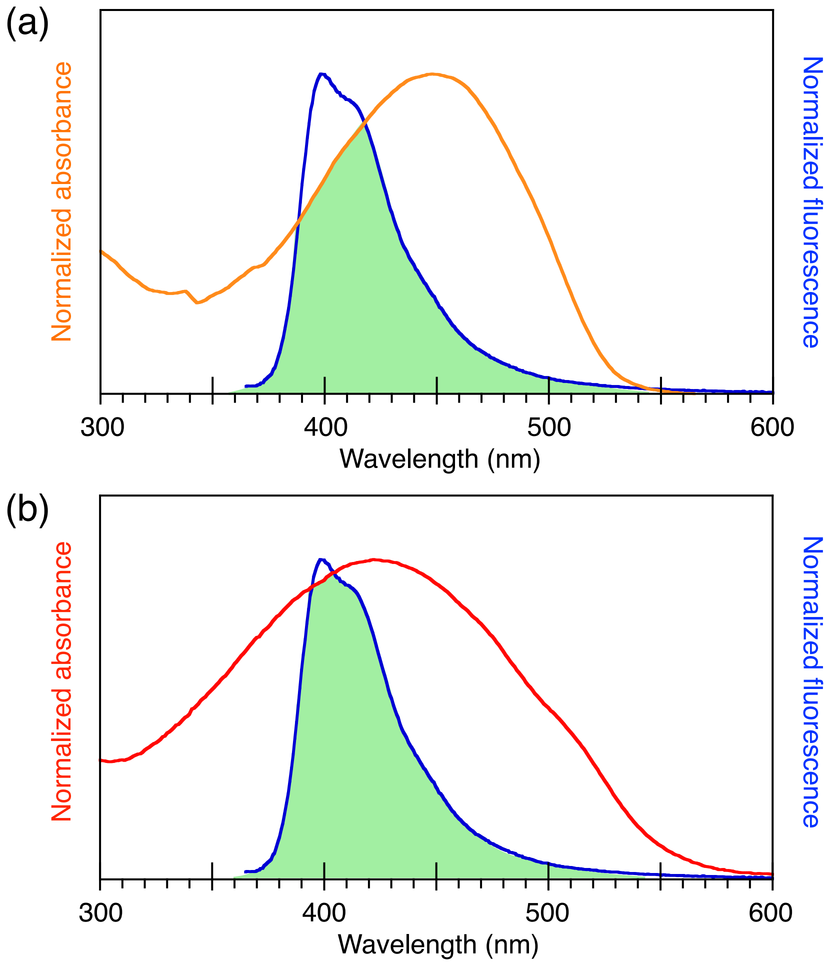


Fig. S1 Spectral overlap between the emission of **D1** (blue line) and absorption of (a) **A1** and (b) **A2** in the film state.

Table S1. Fluorescence QY of **A1** in different solvents.

A1 in different solvents	Fluorescence QY
Toluene	0.36
THF	0.37
DCM	0.35

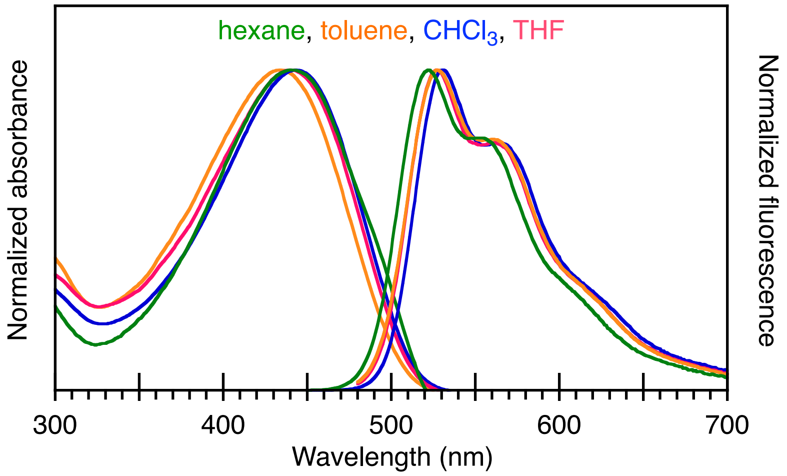


Fig. S2 Absorption and fluorescence spectra of **A1** in different solvents.

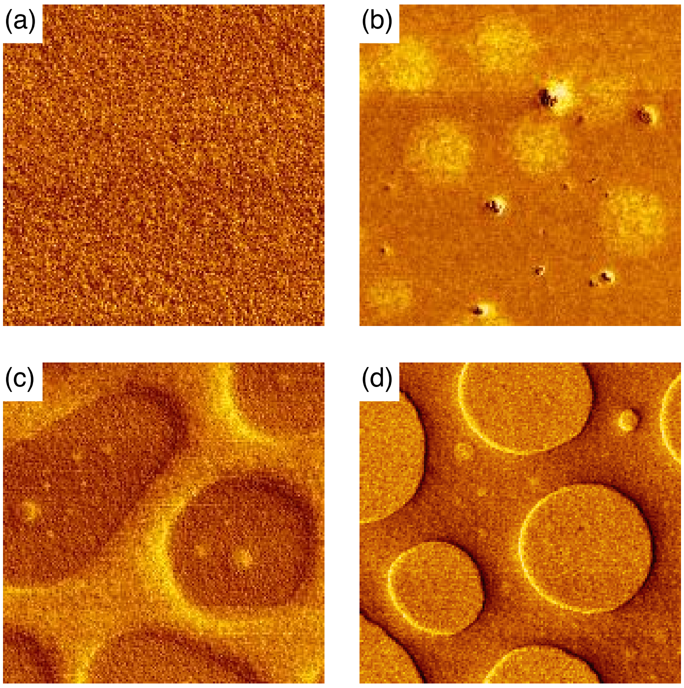


Fig. S3 AFM phase images of polymer blends prepared from (a) **A1/D1**, (b) **A2/D1**, (c) **A1/PMMA**, and (d) **A1/PS**; 1:1 wt/wt%; 2 μm × 2 μm.

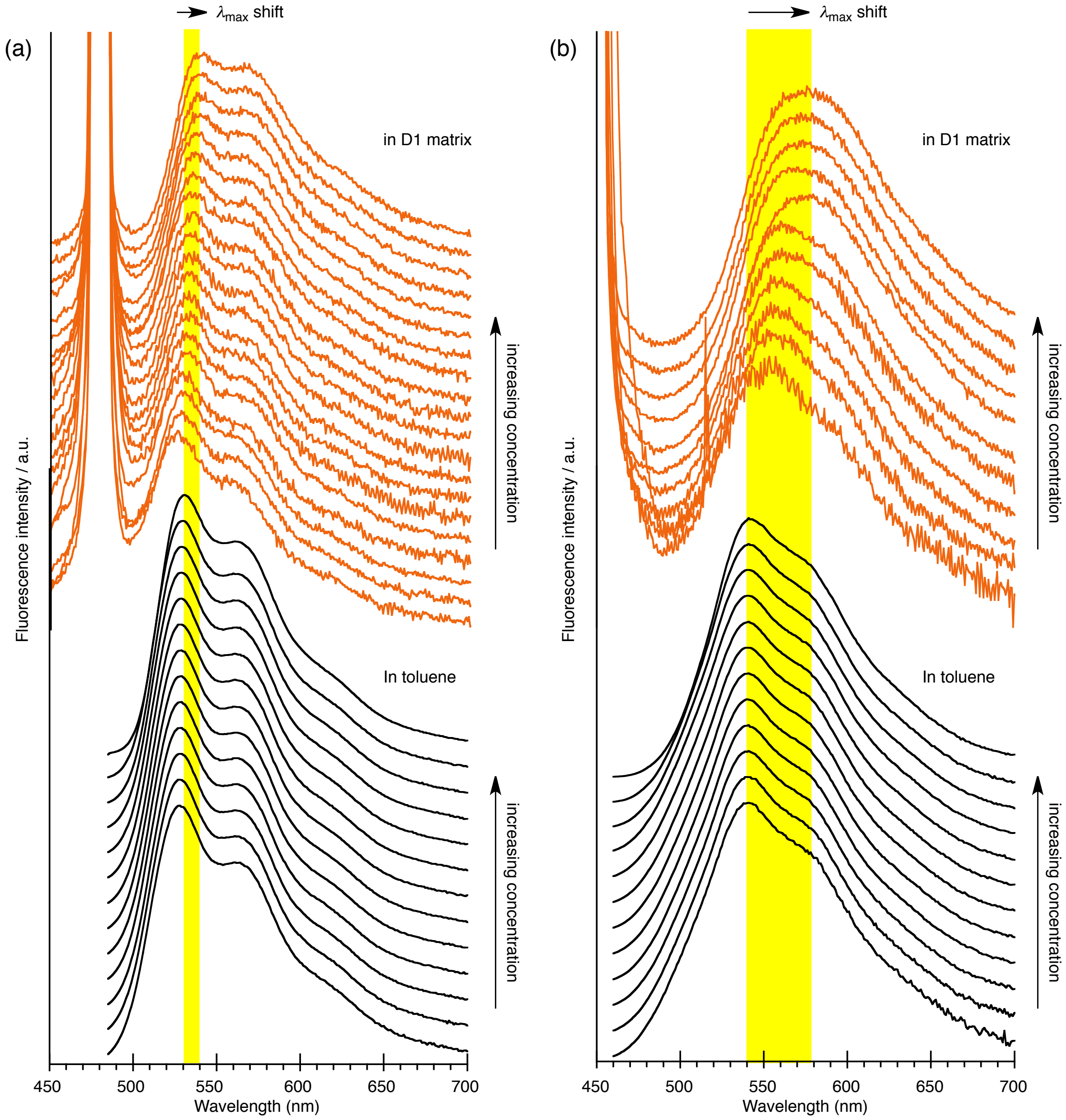


Fig. S4 Fluorescence spectra, shown in a stacked mode, of (a) **A1** and (b) **A2** in toluene (black lines) and **D1** matrix (orange lines) measured as increasing their concentration. The peak shifts are plotted in **Fig. 2** in the main text. λ_{ex} = 480 and 450 nm for **A1** and **A2**.

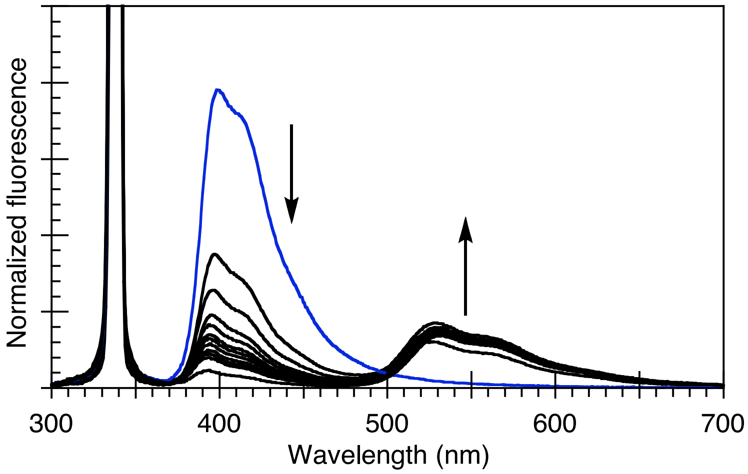


Fig. S5 Fluorescence spectra of **A1/D1** blended films measured with increasing the **A1** ratio, λ_{ex} = 338 nm. Plots of the fluorescence intensities are shown in **Fig. 4**.

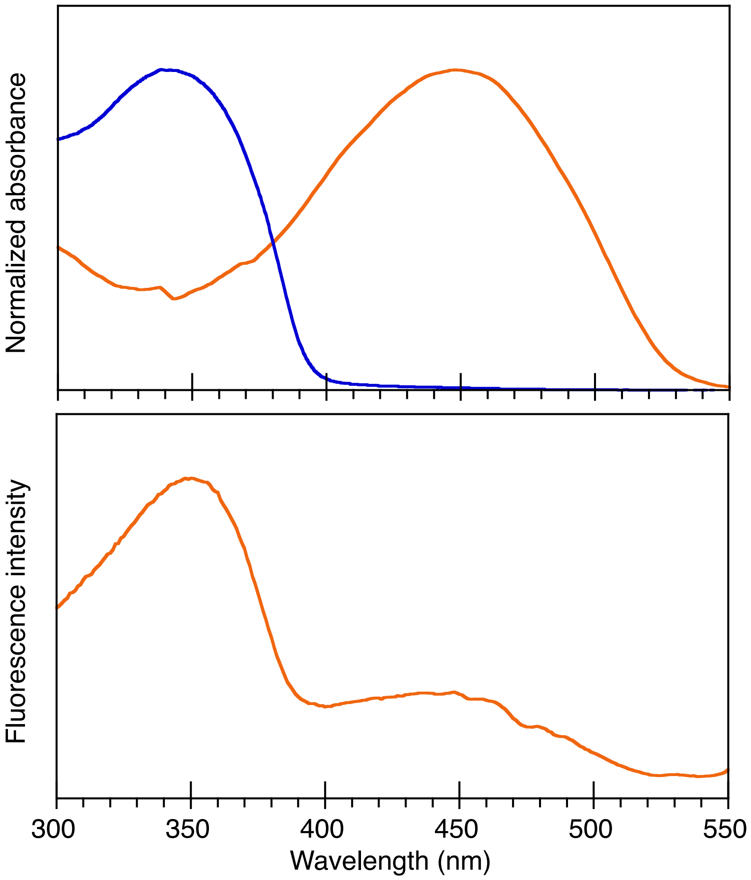


Fig. S6 (a) Absorption spectra of **A1** (orange) and **D1** (blue) in their film forms. (b) Excitation spectrum of the **A1**/**D1** blend (15%, wt/wt) monitored at 580 nm, which indicates the contribution of absorption by **D1** to the fluorescence of **A1**.

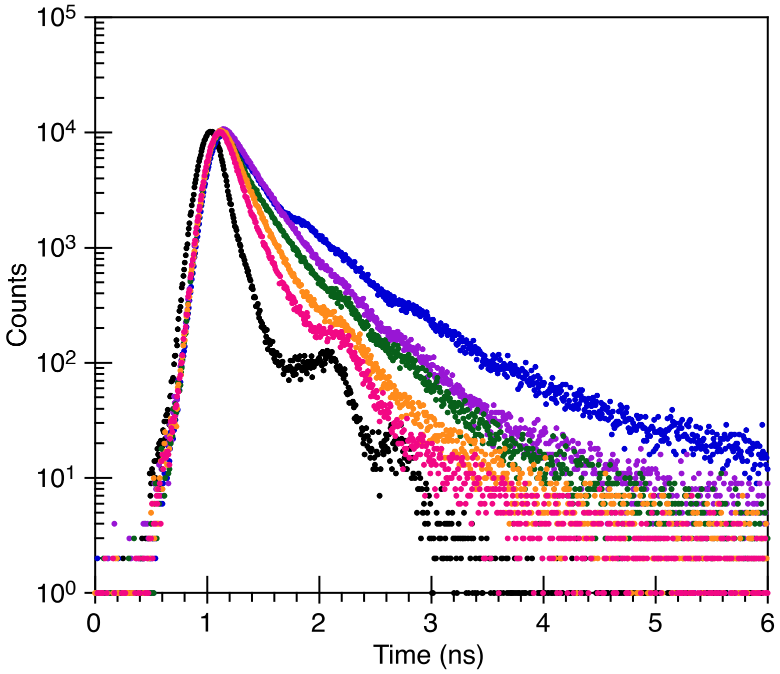


Fig. S7 Fluorescence lifetime decay of **A1**/**D1** blend at different ratios: outer (blue) to inner (red), 0, 1, 3, 5, 15% of **A1** was blended into **D1**: black: IRF, λ_{ex} = 375 nm, λ_{moni} = 420 nm. These results indicate the excited energy transfer from **D1** to **A1** in the blended films.

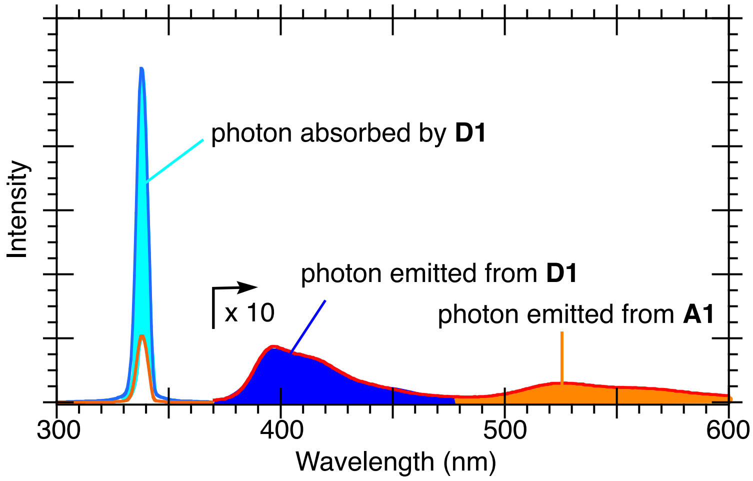


Fig. S8 Fluorescence spectra of **A1**/**D1** blended films ([**D1**] = 1 mol%) excited at 338 nm. The values calculated based on this measurement are plotted in **Fig. 4**.