Supporting Information

Enhanced White-Light Emission from Multiple Fluorophores Encapsulated in a Single Layer of Diblock Copolymer Micelles

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Experimental

Poly (styrene-*block*-4-vinyl pyridine) (**PS-*b*-P4VP**, $M_{n,PS}$ = 47 600 g/mol, $M_{n,P4VP}$ = 20 900 g/mol, M_w/M_n = 1.14) was purchased from the Polymer Source, Inc. Coumarin 343 (**C343**), rhodamine 110 chloride (**R110**) and sulforhodamine 101 (**S101**) were purchased from Sigma-Aldrich and were used as received. Polyfluorene (**PF**) (M_n = 32 500g/mol, M_w/M_n = 1.83) used in this work was synthesized according to the literature.[1]

In a typical experiment, **PS-*b*-P4VP** was dissolved in toluene with a concentration of 2 wt%. Since toluene is a selective solvent for the **PS** block, spherical micelles that consist of a soluble **PS** corona and an insoluble **P4VP** core are formed. **PF** was selected as the blue-light-emitting polymer due to its pure blue-light emission and high photoluminescence (PL) quantum yield, with **R110** and **S101** as green- and red-light-emitting fluorescent dyes, respectively. **C343** was utilized as the light-collecting donor which could be encapsulated in the micellar cores together with light-emitting acceptors **R110** or **S101**, because the emission spectrum of **C343** overlaps well with the absorption spectra of **R110** and **S101** (Fig. S1). The chemical structures of the used conjugated polymer and fluorescent dyes are shown in Fig. S 2.

To obtain enhanced green-light emission, **R110** and **C343** were added to the **PS-*b*-P4VP** micellar solution together and prolonged stirring (~ 3 days) was required to ensure complete encapsulation of dye molecules into the **P4VP** cores. Since **R110** and **C343** were not soluble and remained as powders in toluene without micelles, formation of homogeneous solution of fluorescent dyes with the micelles indicated effective encapsulation of dye molecules into the **P4VP** cores. Thus, a pair of **C343** and **R110** (marked as **C343-R110** hereafter) was incorporated into the same **P4VP** cores and formed **C343-R110**-loaded micellar solution (**PS-*b*-P4VP/C343-R110**), and the molar ratios of **C343** and **R110** to **4VP** units were controlled at 0.020 and 0.008, respectively. Enhanced red-light emission was obtained in the same way by incorporating **C343** and **S101** (marked as **C343-S101** hereafter) into the same **P4VP** core to form **C343-S101**-loaded micellar solution (**PS-*b*-P4VP/C343-S101**) and the molar ratios of **C343** and **S101** to **4VP** units were controlled at 0.020 and 0.010, respectively. **PF** was dissolved in toluene with a concentration of 0.002 wt%. For enhanced white-light emission, **PF** toluene solution, **PS-*b*-P4VP/C343-R110** micellar solution, and **PS-*b*-P4VP/C343-S101** micellar solution were mixed at the weight ratio of 5:12:7 and the blended solution (**PS-*b*-P4VP/PF/C343-R110/C343-S101**) was spin-coated or solvent-cast onto quartz or silicon substrates.

For unenhanced white-light emission, fluorescent dye-loaded micellar solutions without **C343** were prepared in the same way by adding **R110** or **S101** to a separate **PS-*b*-P4VP** micellar solution and the molar ratios of **R110** and **S101** to **4VP** units were controlled to be 0.008 and 0.010, respectively. **PF** toluene solution with a lower concentration (0.0001 wt%), **R110**-loaded micellar solution and **S101**-loaded micellar solution were also mixed at the same ratio of 5:12:7 and the blended solution was spin-coated or solvent-cast onto quartz or silicon substrates. For comparison, thin films of neat **PS-*b*-P4VP**, fluorescent dye-loaded micellar solutions **PS-*b*-P4VP/C343**, **PS-*b*-P4VP/R110**, **PS-*b*-P4VP/S101**, **PS-*b*-**

P4VP/C343-R110, and **PS-*b*-P4VP/C343-S101**, were also prepared by spin-coating or solvent-cast onto quartz or silicon.

AFM images were obtained using a Digital Instruments MultiMode IV in the tapping mode. Steady-state PL spectra and decay profiles were measured by using an EDINBURGH instrument FLS-920 at an excitation wavelength of 380 nm.

[1] U. Scherf and E. J W. List, *Adv. Mater.*, 2002, **14**, 477.

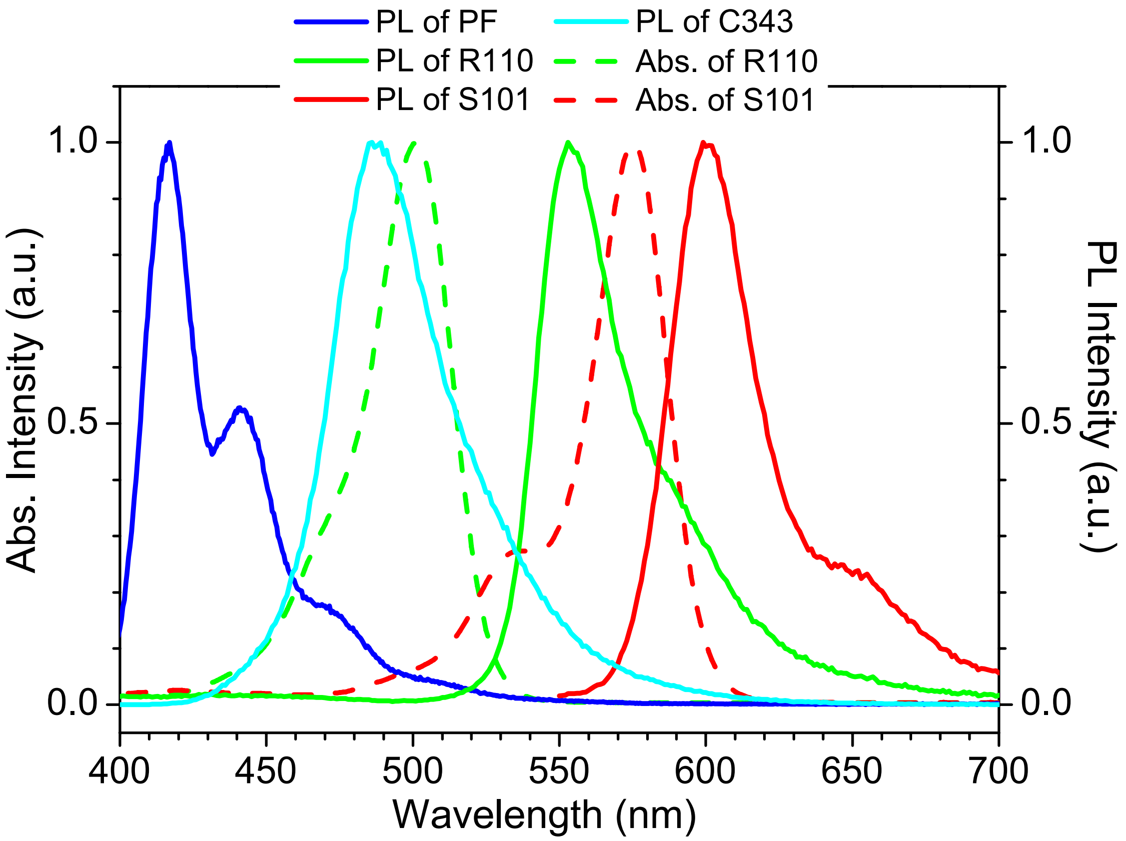
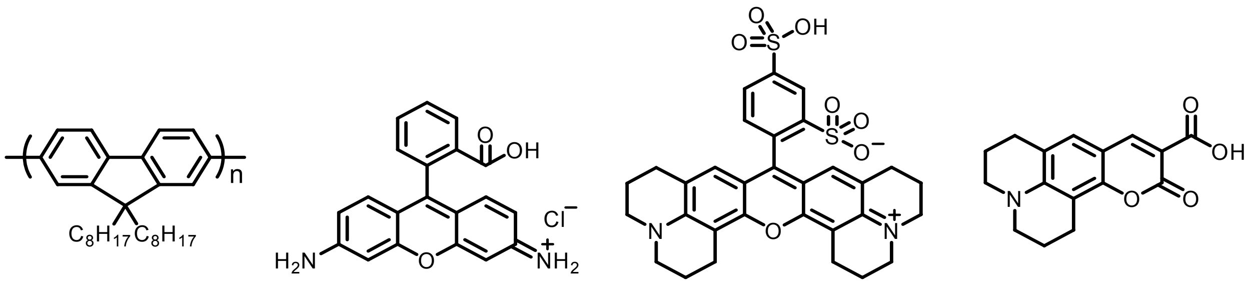


Figure S1. Normalized PL and UV-Vis absorption spectra of **PF** in toluene and fluorescent dyes (**R110**, **S101** and **C343**) in ethanol. The excitation wavelength was 380 nm.



PF **R110** **S101** **C343**

Figure S2. Chemical structures of PF, R110, S101 and C343.

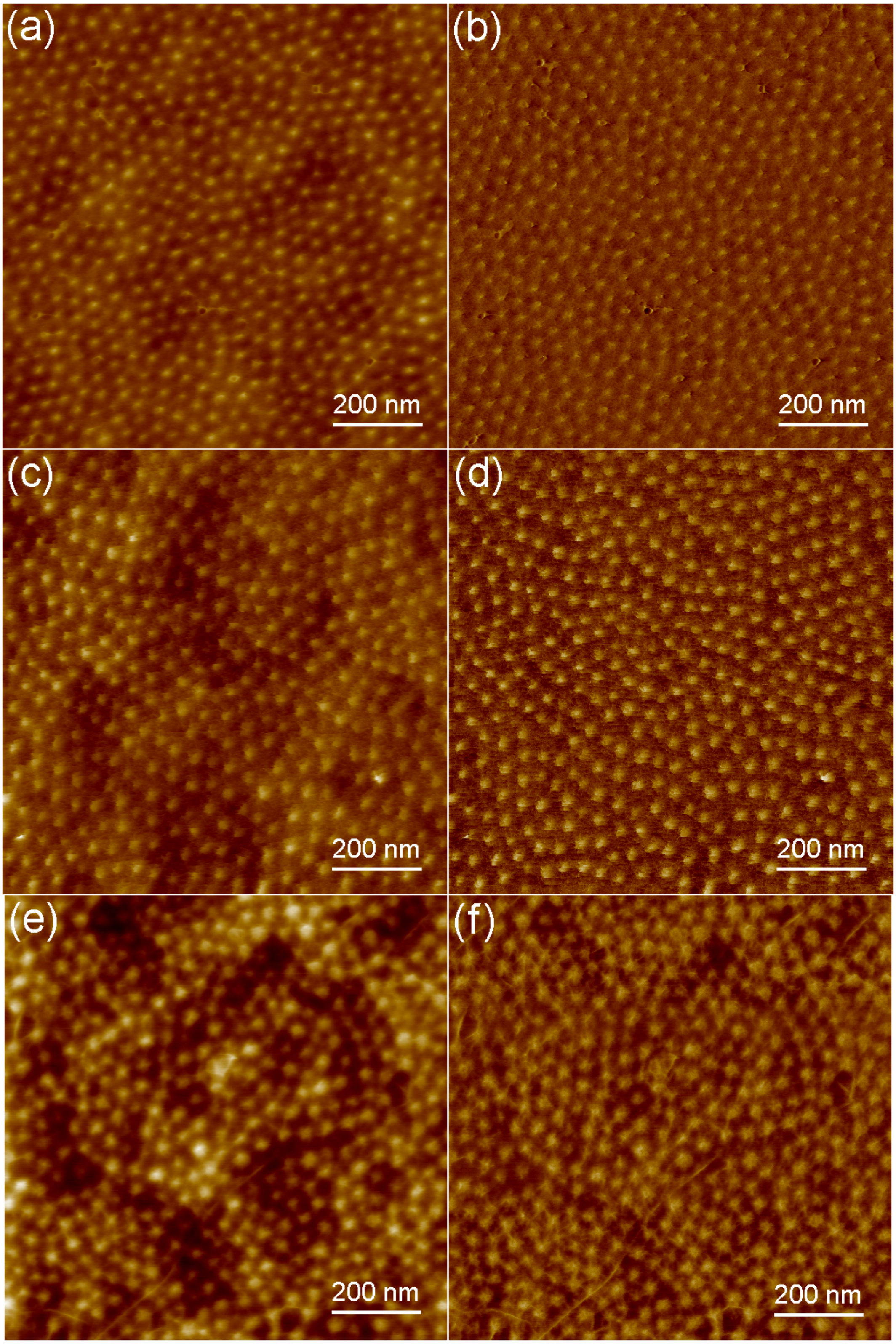


Figure S3. AFM height images of (a) a neat **PS-*b*-P4VP** film, (c) a **PS-*b*-P4VP/PF/R110/S101** hybrid film and (e) a **PS-*b*-P4VP/PF/C343-R110/C343-S101** hybrid film. (b), (d) and (f) are the corresponding phase images of (a), (c) and (e).

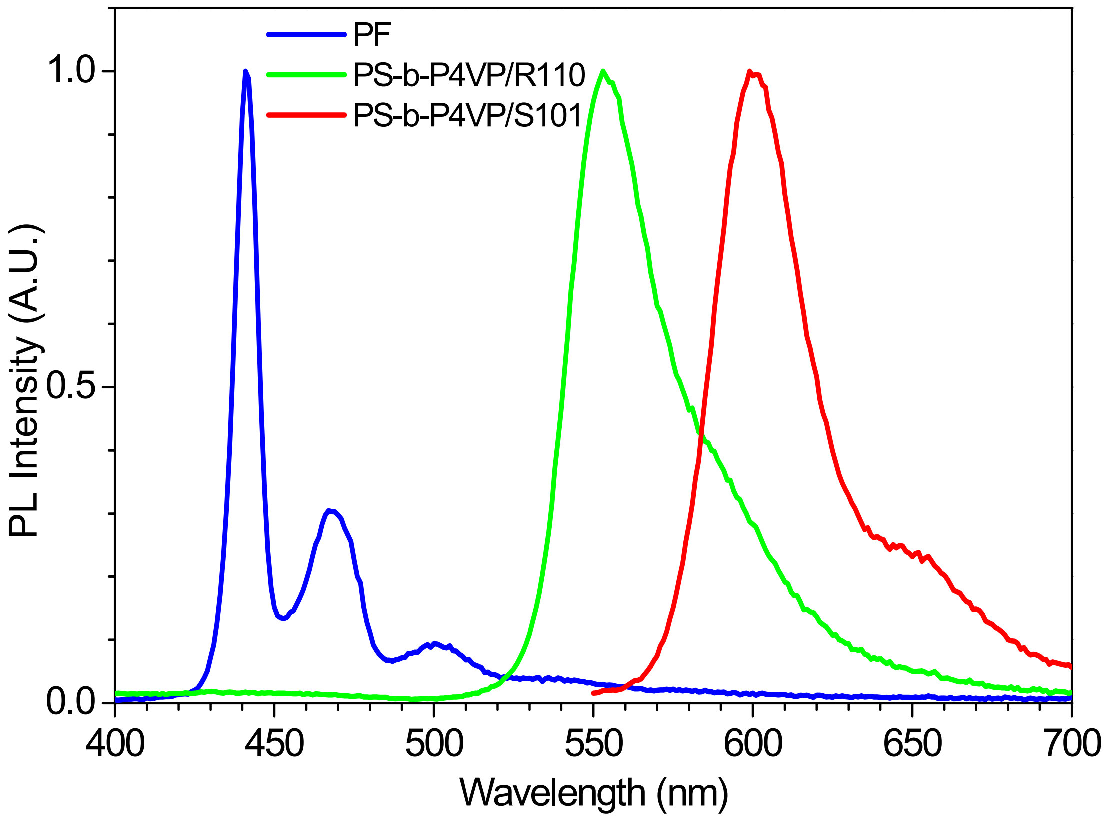


Figure S4. Normalized PL spectra of thin films of **PF, PS-*b*-P4VP/R110** and **PS-*b*-P4VP/S101**. The excitation wavelength was 380 nm in all cases.

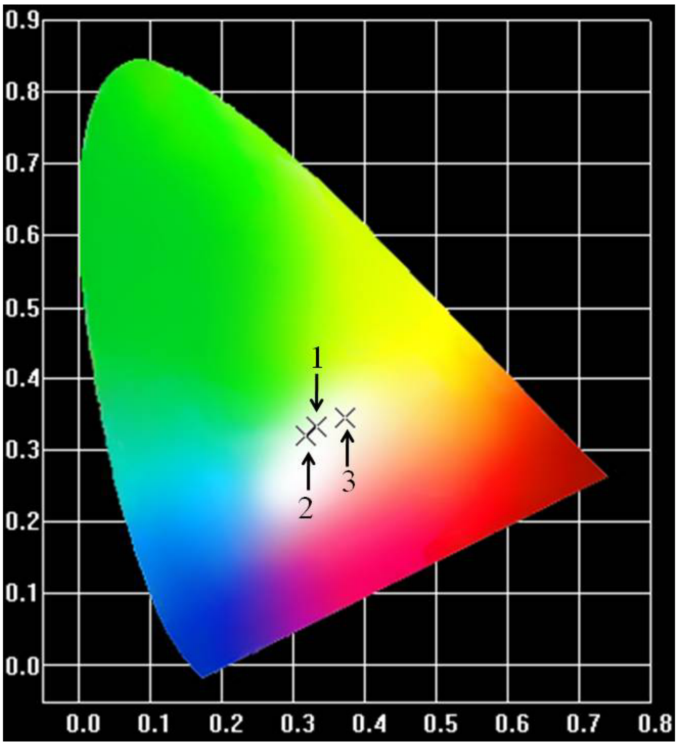


Figure S5. CIE chromaticity diagram showing the coordinates of standard white light (point 1), enhanced white light (point 2) and unenhanced white light (point 3).