Electronic Supplementary Information

Short-Range Ordered Photonic Structures of Lamellae-Forming Diblock Copolymers for Excitation-Regulated Fluorescence Enhancement

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Statistical results for steady-state fluorescence of R123 in the bulk film

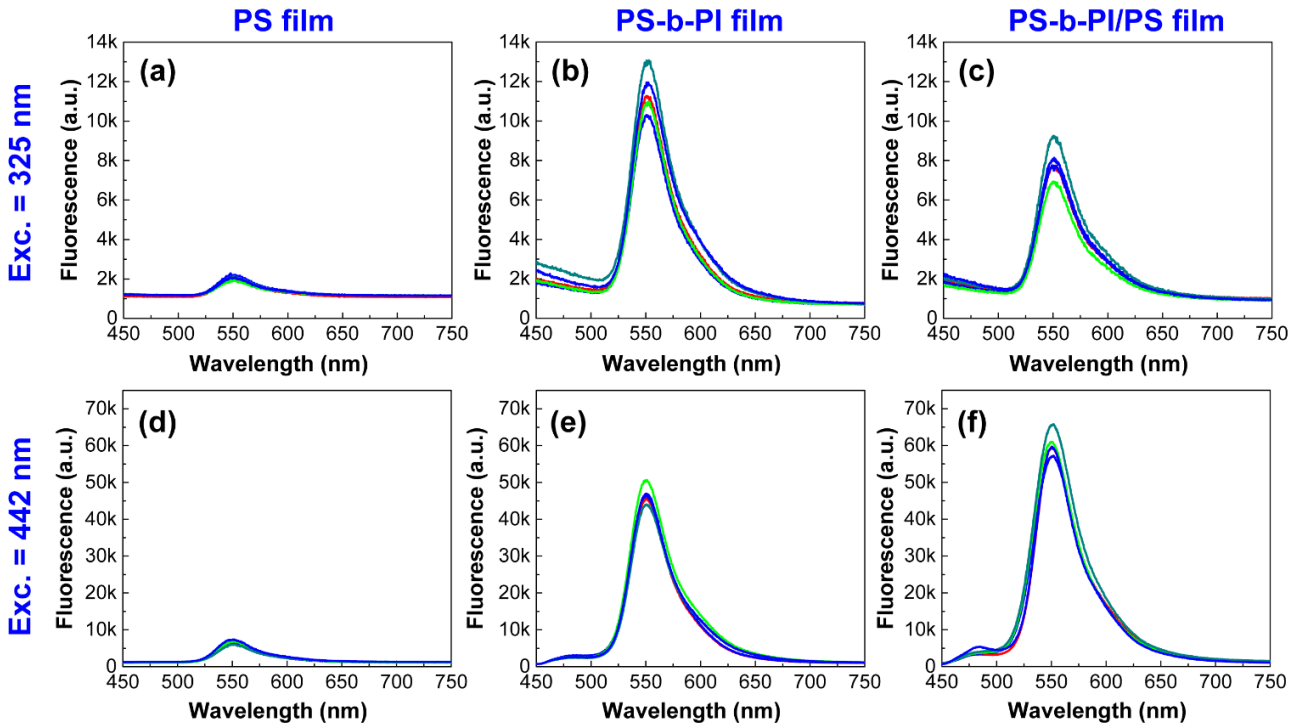

Figure S1. Steady-state fluorescence spectra of bulk films of (a, d) PS, (b, e) PS-*b*-PI, and (c, f) PS-*b*-PI/PS polymers embedded with PS-*b*-PVP micelles containing R123. The excitation wavelengths were 325 nm for (a) – (c) and 442 nm for (d) – (e), respectively.

SAXS experiment

Even though TEM is a powerful technique for the structural analysis in a microscopic view, the structural information obtained from TEM image might contain inevitable errors as described in the main text. In this regard, the short-range ordered lamellar structure has been additionally analyzed by small-angle X-ray scattering (SAXS) experiments to provide more statistical data in a macroscopic view. In Figure S2, 1D SAXS profile for PS-*b*-PI film exhibited well-developed lamellar structures; this can be assessed by the high order peaks appeared at integer orders of the first peak position. The lamellar periodicity was evaluated as 128 nm from the scattering vector of the first order peak. In addition, the orientation of

grains of lamellae has found to be mainly isotropic as confirmed from the inserted 2D SAXS patterns collected at different positions. Note, the nearly isotropic 2D patterns could be ascribed to the fact that X-ray beam size of several hundreds of micrometer is much larger than the grain size of lamellae. If we could assume that the layer thicknesses of PS (d_{PS}) and PI (d_{PS}) blocks were the same, then the theoretical stop band of PS-*b*-PI film would be evaluated as 396 nm by using a relation of $\lambda = 2 \times (n_{PS}d_{PS} + n_{PI}d_{PI})$, where n_{PS} and n_{PI} are the refractive indices of PS and PI layers, respectively. Note, the calculated value is relatively good agreement with the experimental stop band of PS-*b*-PI film (375 nm).

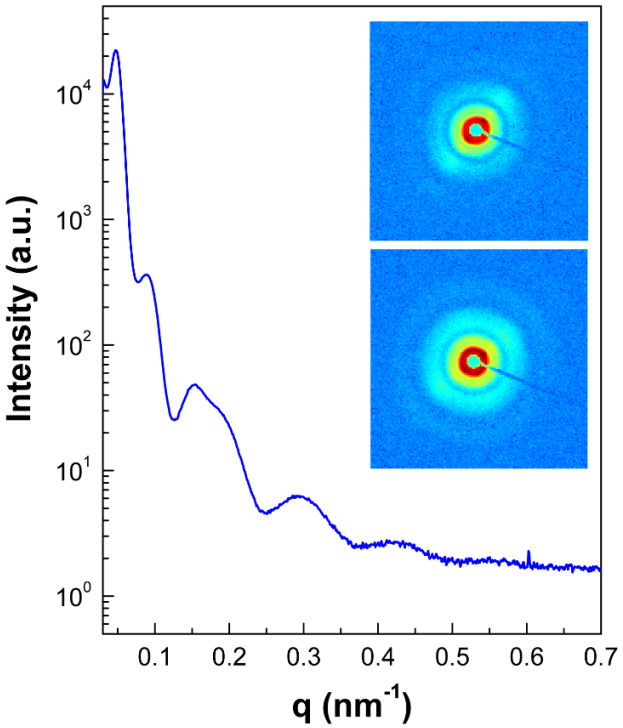

Figure S2. 1D and 2D SAXS patterns of PS-*b*-PI film. Transmission small-angle x-ray scattering (TR-SAXS) measurement was conducted at PLS-II 9A U-SAXS beamline of Pohang Accelerator Laboratory (PAL) in Korea. The X-rays coming from the in-vacuum undulator (IVU) are monochromated using Si (111) double crystals and focused at the detector position using K-B type mirrors. The measuring conditions were chosen as a wavelength of 1.18 Å and a sample-to-detector distance of 7 m.

Experimental reflectivity

As discussed in the main text, different parts of the photonic film have collective effects for the enhancement mechanism. However, since the overall enhancement process would not be operative without the presence of grains of short-ranged ordered lamellae, the lamellae in middle of film would have the fundamental importance among others. To better quantify the optical property of polymer film, the actual reflectivity of the bulk film of PS-*b*-PI copolymers was measured as shown in Figure S3. Here, reflectivity measurement was performed on a Cary 500 UV-Vis-NIR spectrophotometer equipped with an integrating sphere diffuse reflectance accessory, which was referenced to a standard sample having 99% reflectivity. The measured reflectivity is different from the ideal reflectivity in the main text, and alternatively supports the short-range nature of lamellar structures

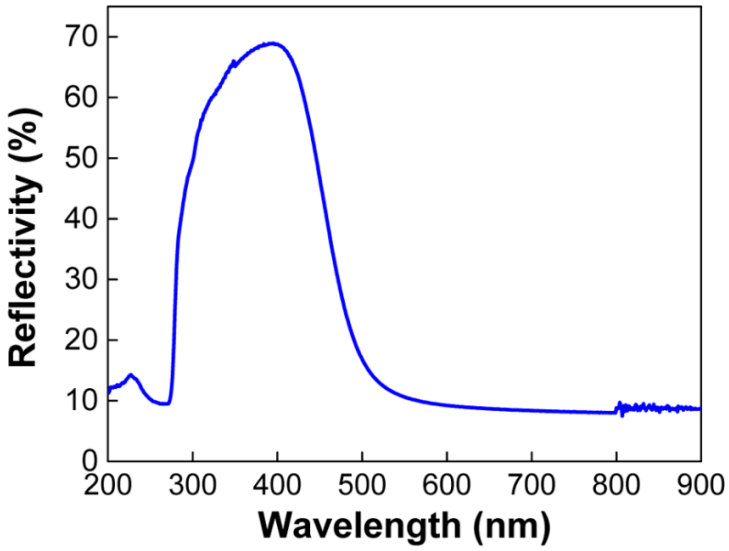

Figure S3. Reflectivity spectrum of bulk film of PS-*b*-PI copolymers.

Statistical results for steady-state fluorescence of QDs in the bulk film

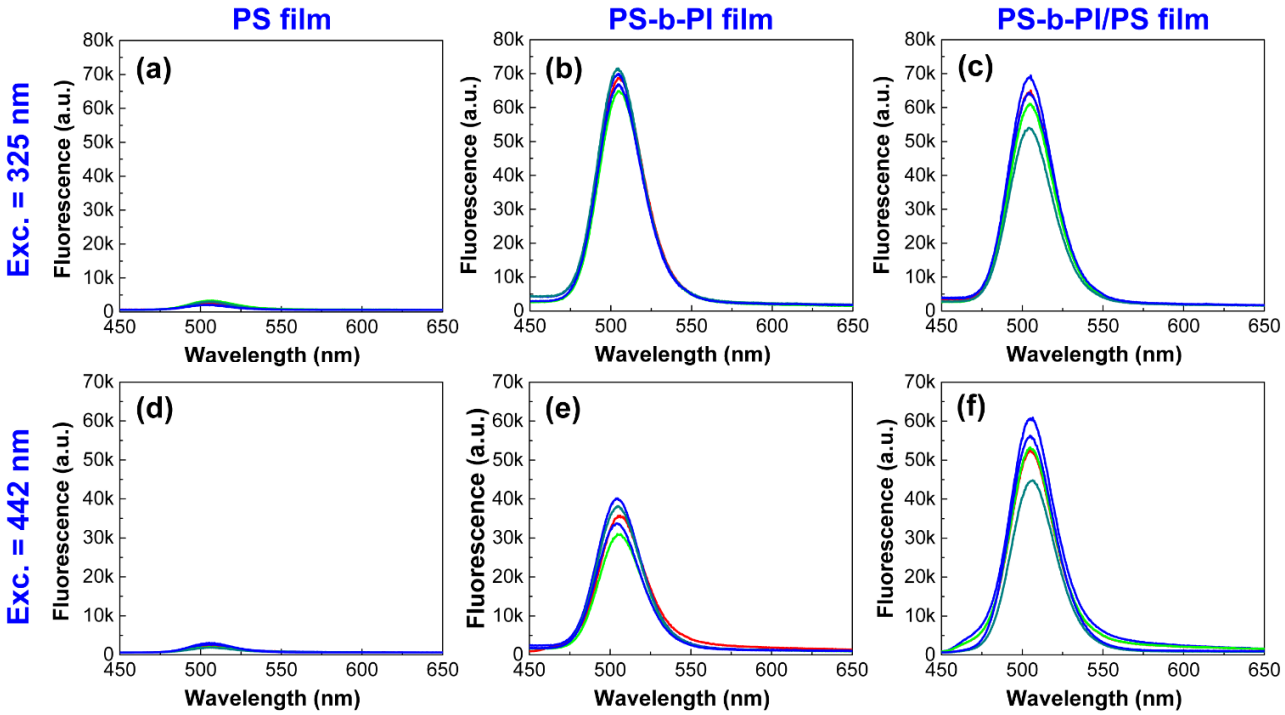

Figure S4. Steady-state fluorescence spectra of bulk films of (a, d) PS, (b, e) PS-*b*-PI, and (c, f) PS-*b*-PI/PS polymers embedded with PS-coated QDs. The excitation wavelengths were 325 nm for (a) – (c) and 442 nm for (d) – (e), respectively.