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**Supporting Information**

# Investigation of Supramolecular Interactions between Liquid Crystals and PCBM for Improved Morphological Stability in Solar Cells

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Author contributions. Kunxing Hu and Weihua Zhou contributed equally to this work.

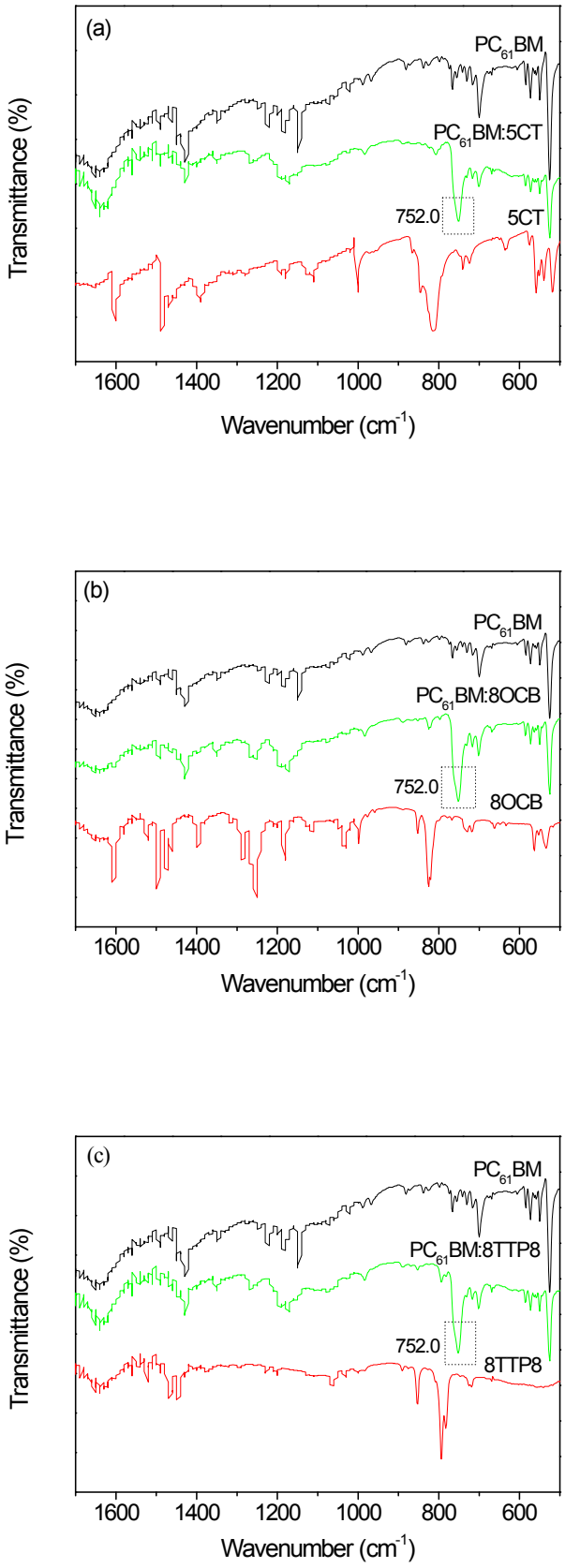


**Figure S1** FTIR spectra of the binary blends based on (a) $PC_{61}BM$:8TTP8, (b) $PC_{61}BM$:8OCB and (c) $PC_{61}BM$:5CT, respectively.

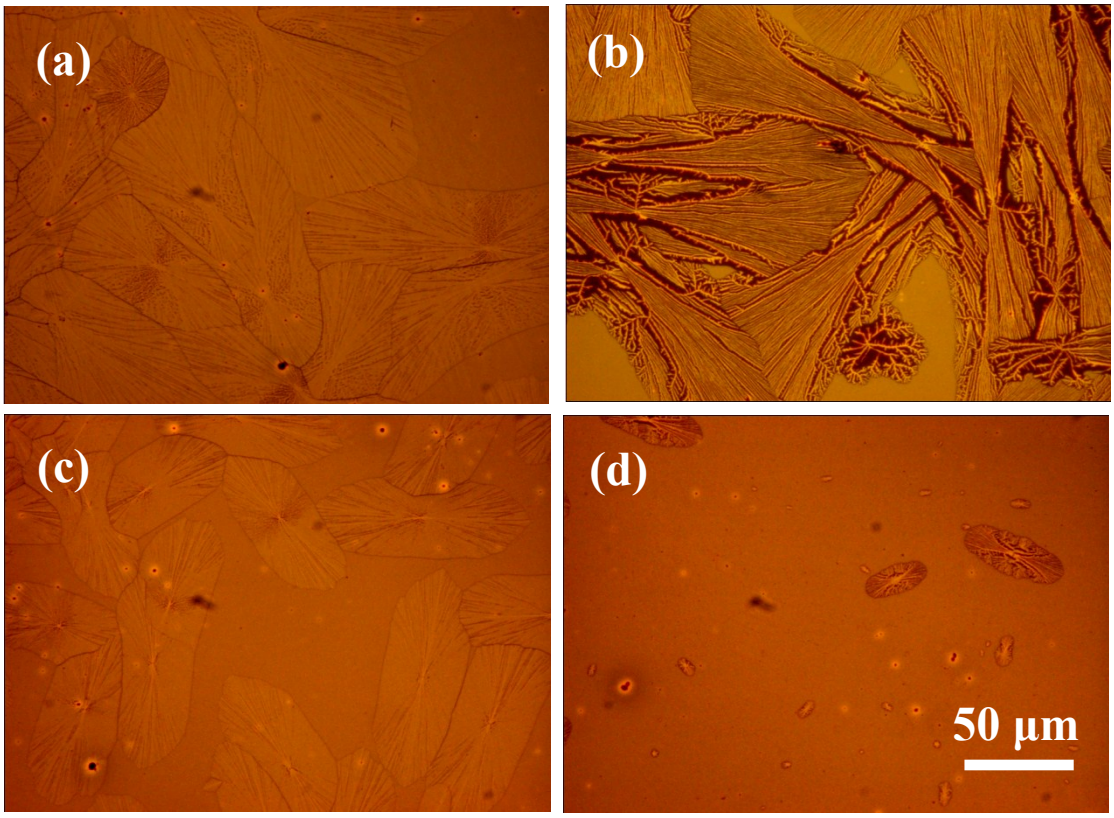


**Figure S2** The POM images of the specimens of (a) P3HT:$PC_{61}$BM (0.05:1), (b) P3HT:$PC_{61}$BM:8TTP8 (0.05:1:0.06), (c) P3HT:$PC_{61}$BM:8OCB (0.05:1:0.06) and (d) P3HT:$PC_{61}$BM:5CT (0.05:1:0.06) after annealing at 200 °C for 10 min.

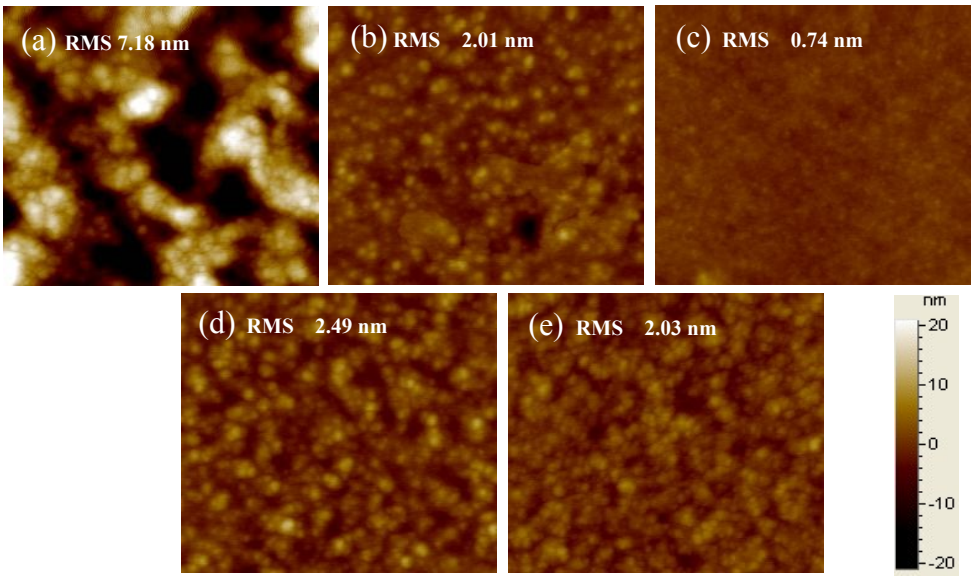


**Figure S3** AFM images for specimens of (a) P3HT:$PC_{61}BM$, (b) P3HT:$PC_{61}BM$:8TTP8, (c) P3HT:$PC_{61}BM$:8TTP8 with electric field treatment, (d) P3HT:$PC_{61}BM$:8OCB, and (e) P3HT:$PC_{61}BM$:8OCB with electric field treatment. The electric field strength is 600 V/mm, and the scan areas are 5×5 μm.

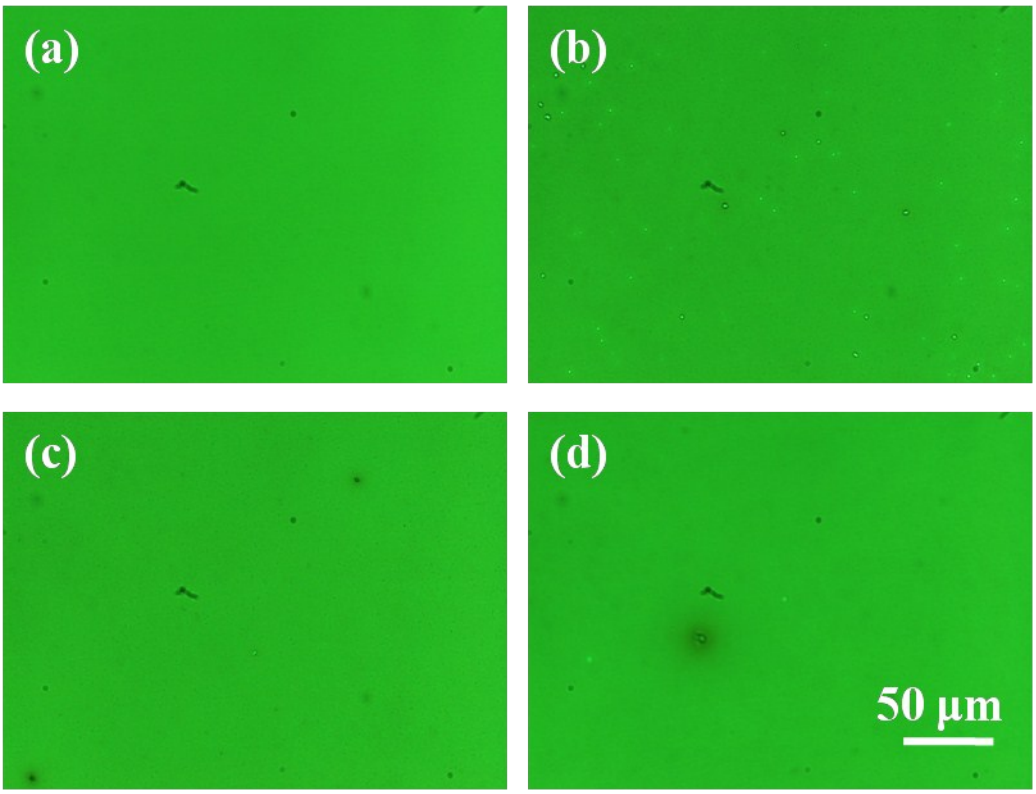


**Figure S4** POM images of (a) P3HT:$PC_{61}BM$, (b) P3HT:$PC_{61}BM$:8TTP8, (c) P3HT:$PC_{61}BM$:8OCB and (d) P3HT:$PC_{61}BM$:5CT films without heating treatment. The images were taken after adding a quarter-wave optical filter.

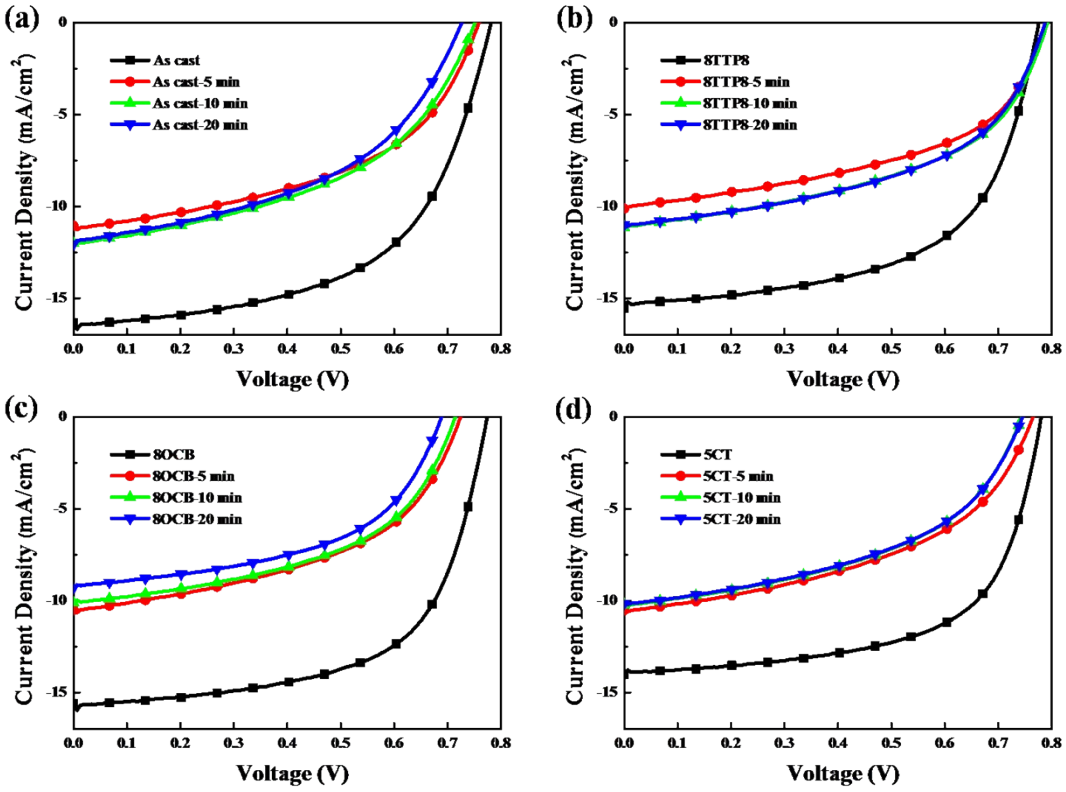


**Figure S5** Current-voltage (*J-V*) characteristics of solar cells based on (a) PTB7-Th:$PC_{71}BM$, (b) PTB7-Th:$PC_{71}BM$:8TTP8, (c) PTB7-Th:$PC_{71}BM$:8OCB, (d) PTB7-Th:$PC_{71}BM$:5CT specimens after heating at 150 ºC for different time.

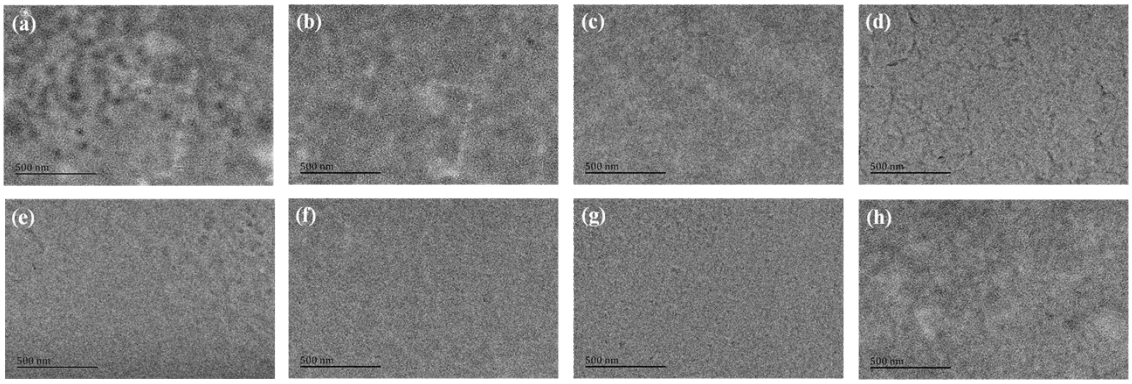


**Figure S6** TEM images of specimens (a) PTB7-Th:$PC_{71}BM$, (b) PTB7-Th:$PC_{71}BM$:8TTP8, (c) PTB7-Th:$PC_{71}BM$:8OCB, (d) PTB7-Th:$PC_{71}BM$:5CT before thermal annealing (up), and specimens (e) PTB7-Th:$PC_{71}BM$, (f) PTB7-Th:$PC_{71}BM$:8TTP8, (g) PTB7-Th:$PC_{71}BM$:8OCB, (h) PTB7-Th:$PC_{71}BM$:5CT after thermal annealing (below) at 150 ºC for 20 min.

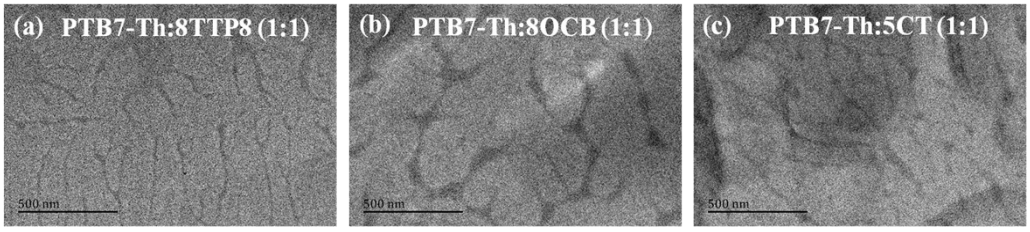


**Figure S7** TEM images of binary blend films of (a) PTB7-Th:8TTP8, (b) PTB7-Th:8OCB and (c) PTB7-Th:5CT.

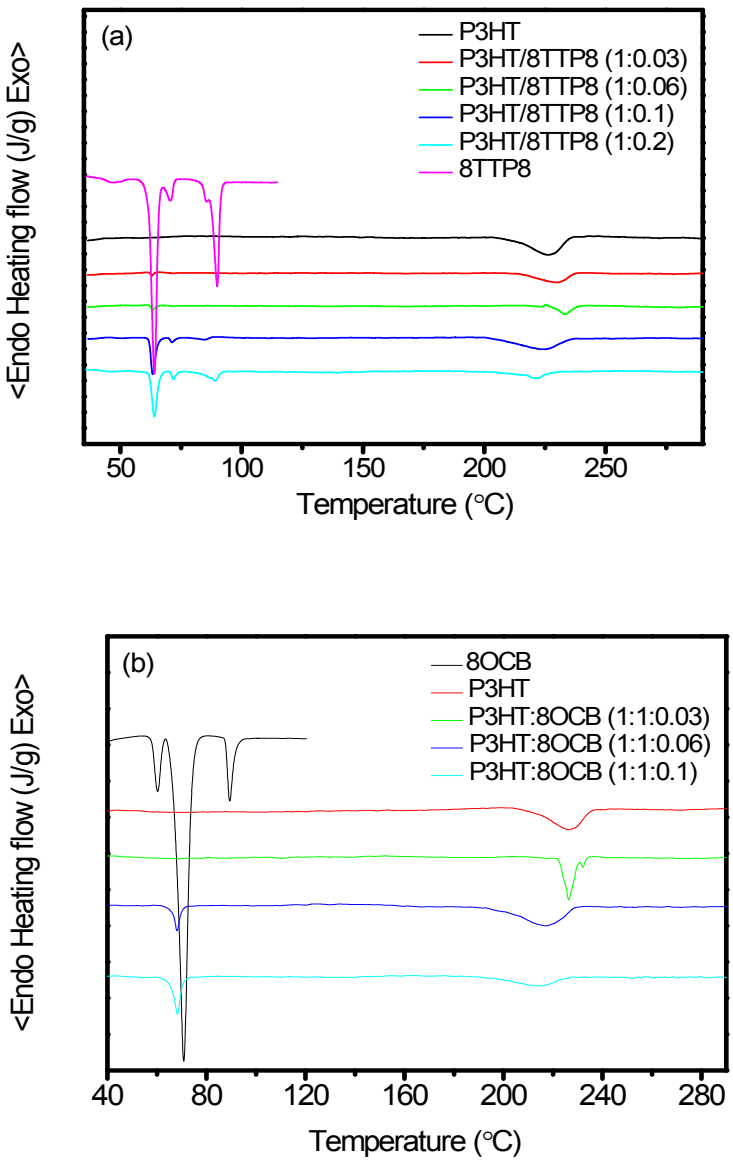


**Figure S8** DSC heating curves of P3HT:8TTP8 and P3HT:8OCB blends at different weight ratios of liquid crystals.

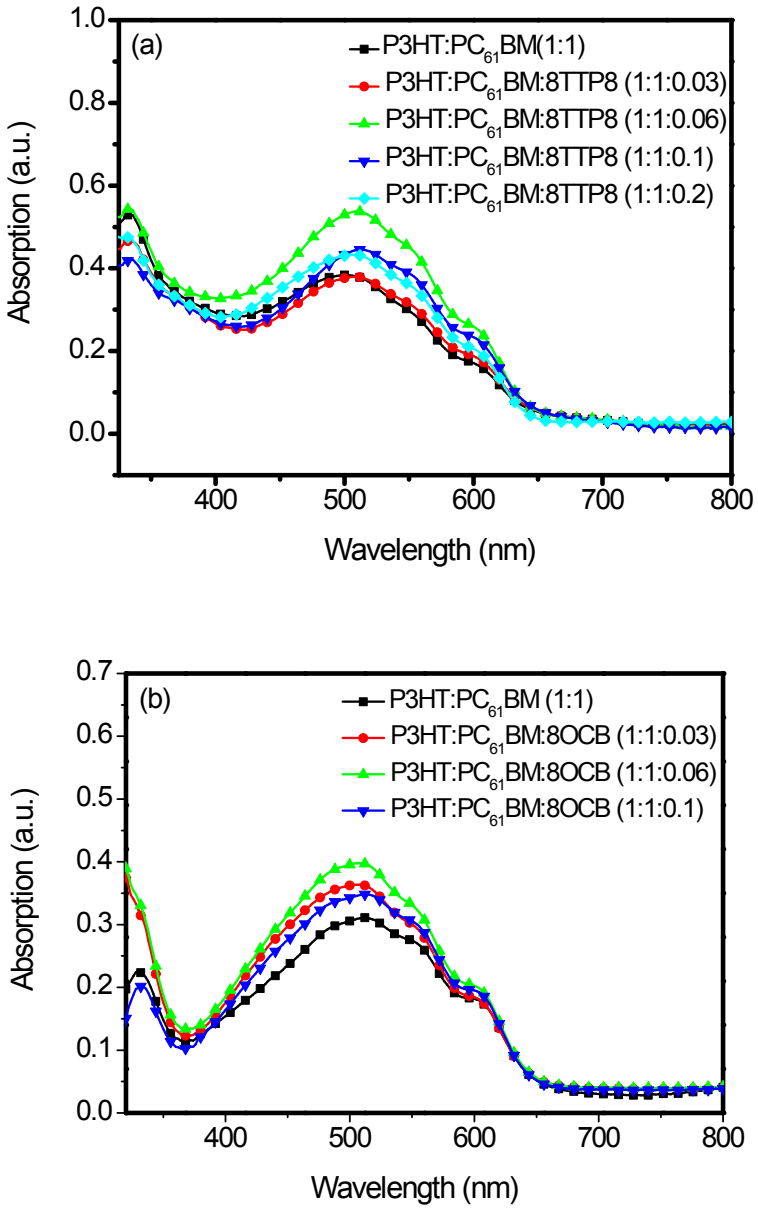


**Figure S9** UV-vis spectra of the (a) P3HT:$PC_{61}$BM:8TTP8 and (b) P3HT:$PC_{61}$BM:8OCB ternary blend films at different weight fraction of liquid crystals.

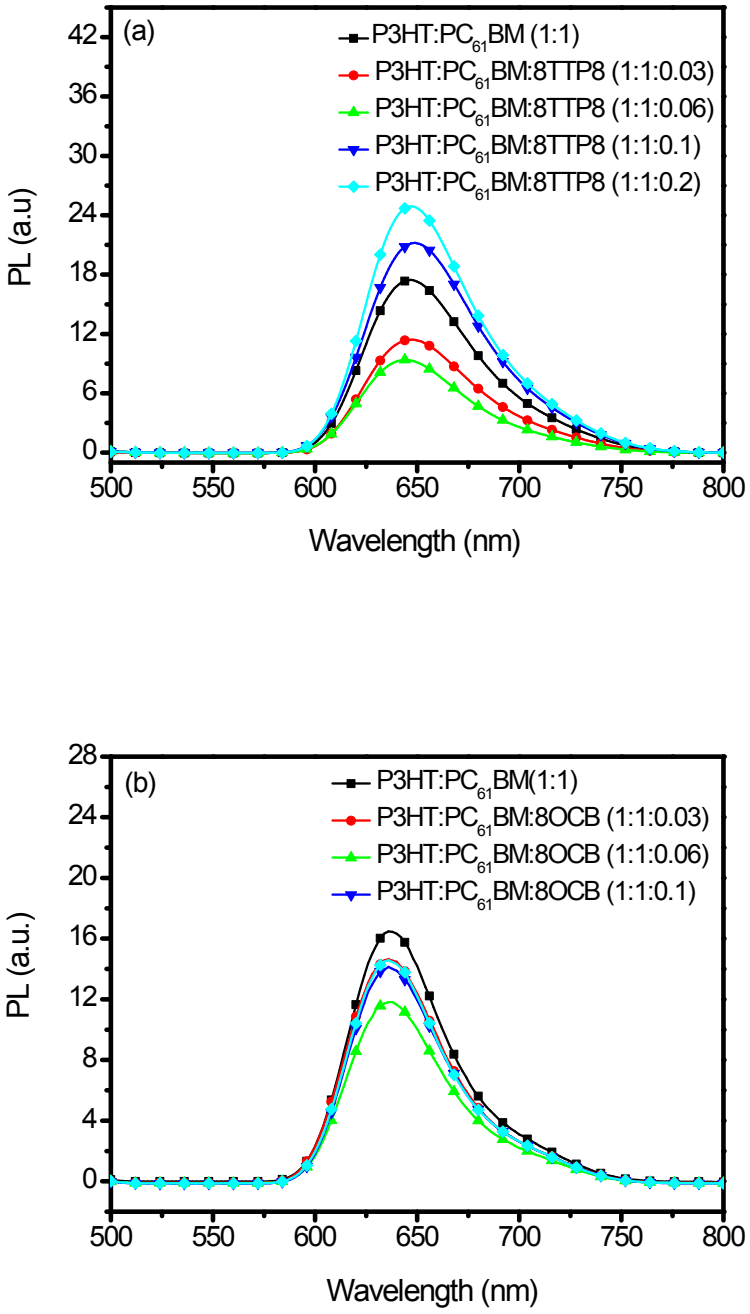


**Figure S10** The photoluminescence spectra of (a) P3HT:$PC_{61}$BM:8TTP8 and (b) P3HT:$PC_{61}$BM:8OCB ternary blend films at different weight fraction of liquid crystals.

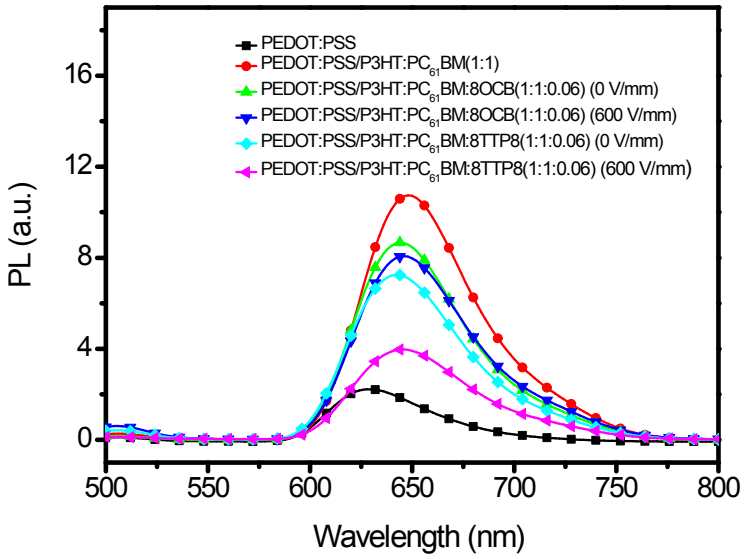


**Figure S11** The photoluminescence spectra of PEDOT:PSS/P3HT:$PC_{61}$BM:8TTP8 (1:1:0.06) and PEDOT:PSS/P3HT:$PC_{61}$BM:8OCB (1:1:0.06) films after electric field treatment at 0 V/mm and 600 V/mm.