Supplementary Material (ESI) for RSC Advances

Electronic Supplementary Information

An aqueous soaking treatment for efficient polymer solar cells

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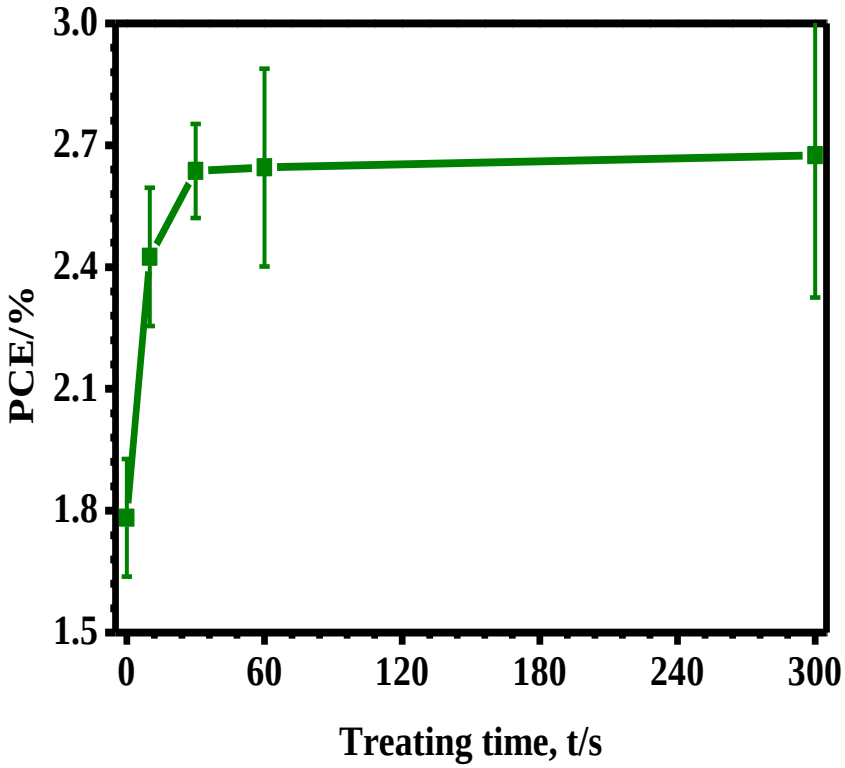

Fig.S1 Device efficiency versus treating time. The CS_2 concentration in aqueous solution is 0.13wt%.

When the soaking time is increased to 30 seconds, device efficiency reaches the equilibrium status. To ensure the sufficient treatment, the soaking time is set to 1 minute.

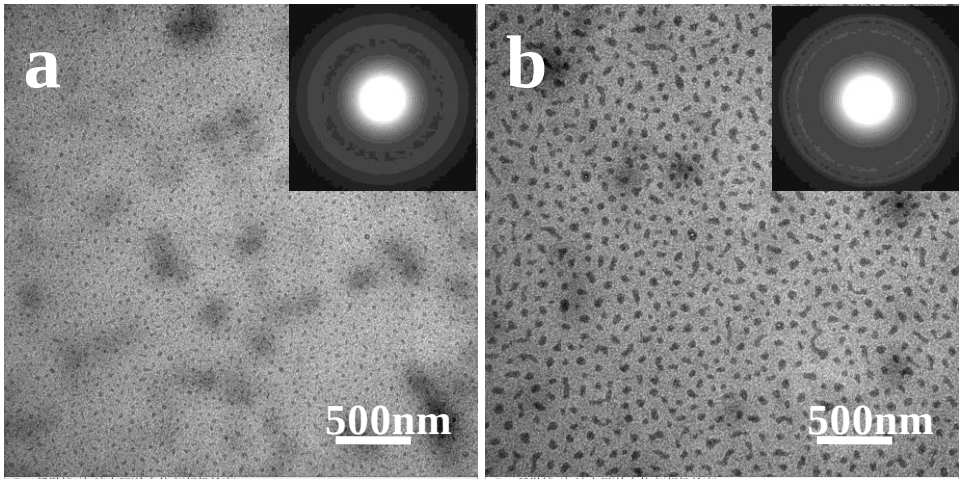

Fig.S2 Bright-field transmission electron microscopy (BF-TEM) images and corresponding selected-area electron diffraction (SAED) patterns of P3HT/PCBM blend films treated with aqueous solutions containing CS_2 concentration of 0.05wt% (a) and 0.10wt% (b), respectively.

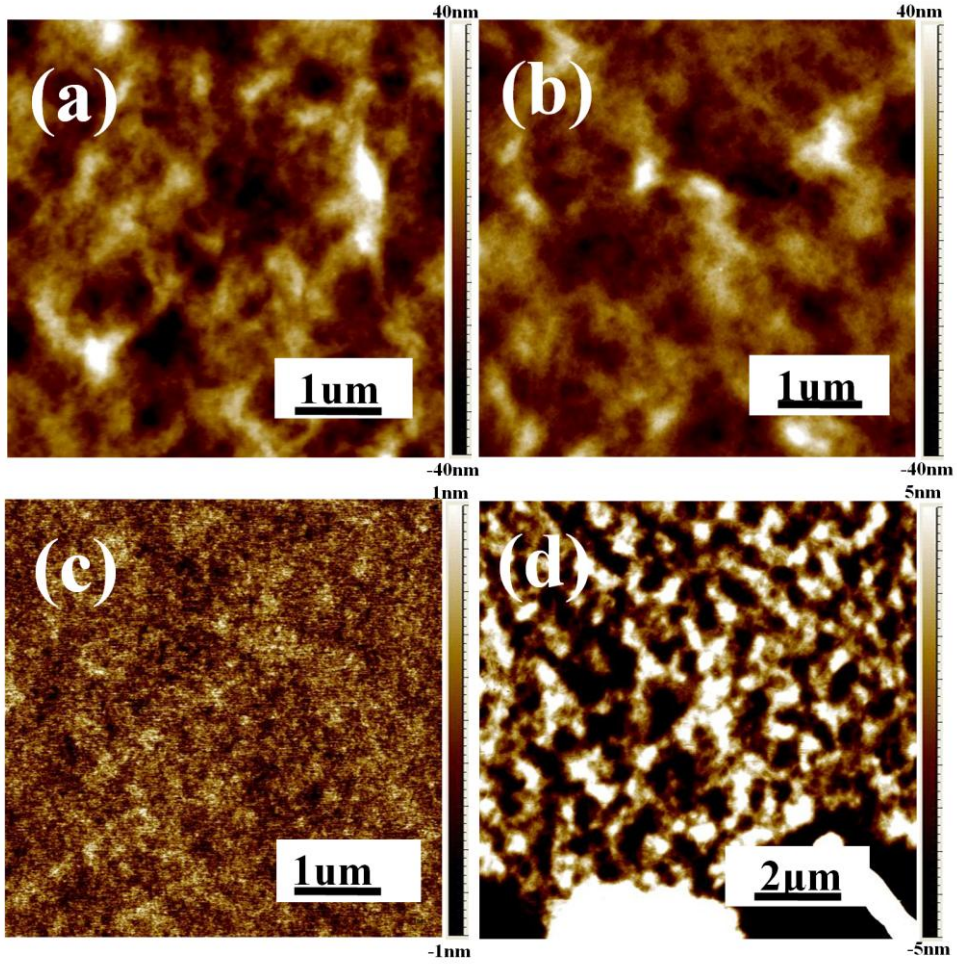

Fig.S3 AFM topography images of top surfaces of pristine (a) and soaking treated (b) pure P3HT films, and pristine (c) and soaking treated (d) pure PCBM films.

Upon soaking treatment, the topography of pure P3HT film is unchanged, while PCBM aggregates are generated and the surface roughness increases from 0.9 nm to 50.9 nm. It is believed that PCBM aggregation is resulted from the relatively high mobility due to its low molecular weight under the conditions.

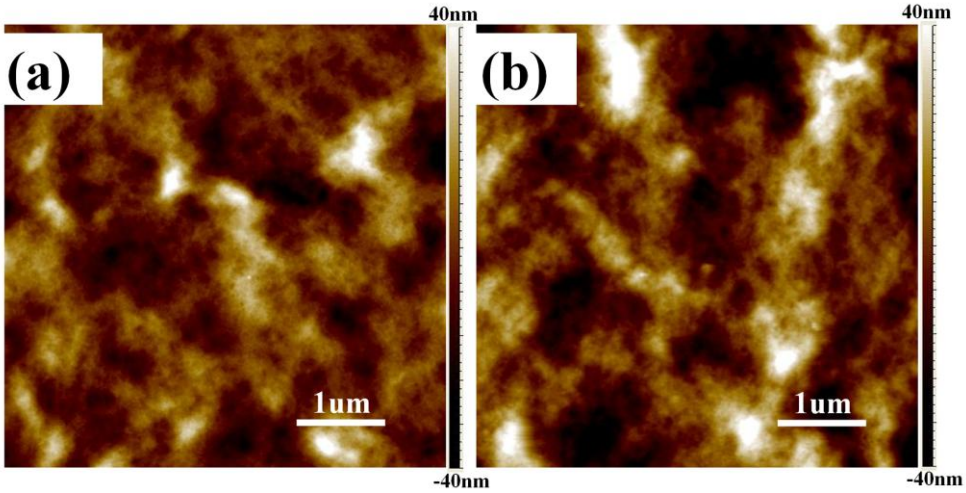

Fig.S4 AFM topography images of soaking treated pure P3HT films before (a) and after (b) OT etching.

After etching treatment, the morphology of P3HT film is unchanged.

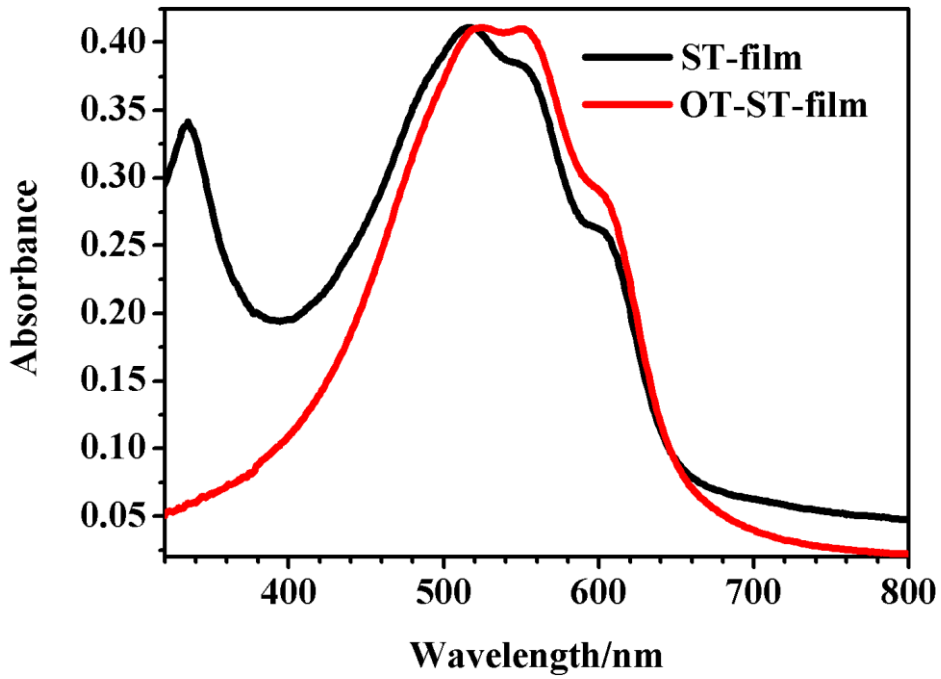

Fig.S5 UV-Vis absorption spectra of soaking treated (ST-film) and the OT etched soaking treated (OT-ST-film) P3HT/PCBM blend films.

The ST-film shows an absorption peak at 333 nm, which represents the existence of PCBM component in the P3HT/PCBM blend film. After rinsing with OT, this peak disappears, indicating that PCBM component is selectively removed from the blend film. Although this figure shows that the OT etching also increases P3HT crystallinity, this change could not apparently affect the morphology of P3HT film, as observed in **Fig.S4**.

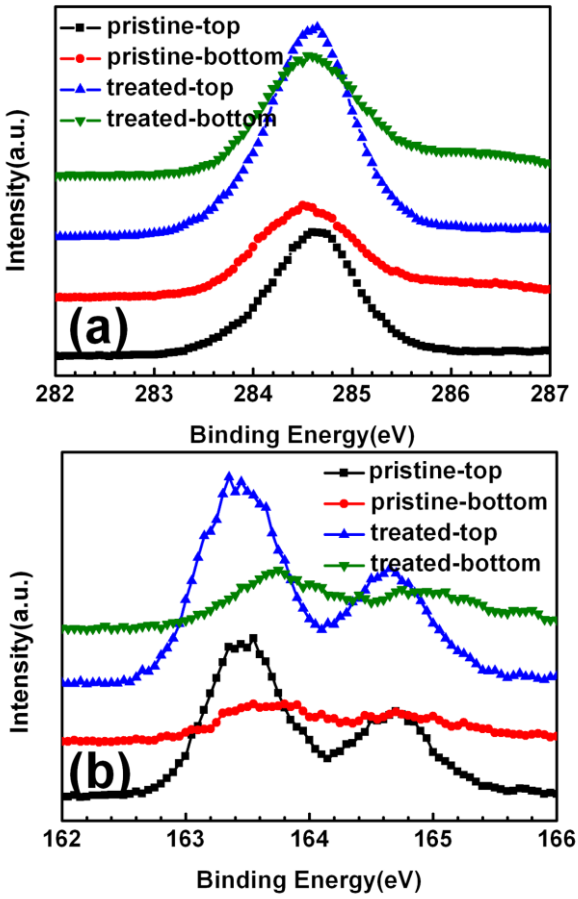

Fig.S6 XPS spectra of C 1s (a) and S 2p (b) elements obtained from top and bottom surfaces of pristine and soaking treated P3HT: PCBM films.

The S 2p spectra from the P3HT: PCBM film exhibits a binding energy peak at around 164 eV. The weight or molar ratio of the components could be calculated directly from the peak area ratios of individual elements. The S 2p originates from P3HT while C 1s represents both P3HT and PCBM components, and the S 2p/C 1s peak area ratio could be proportionally correlated to the percentage of P3HT in the composite.