Supporting Information

Wettability control of conjugated polymer films by electric-field polarization technique

Su Yan[ab#], Wei Li[a#], Huan Bi[ab], Mian Wang[ab], De Sun[a], Qi Wei[ab] , Shiwei Wang*[ab] , Zhe Wang[ab] and Mingyao Zhang[a]

a School of Chemical Engineering, Changchun University of Technology, Changchun, 130012, P. R. China.

b Advanced Institute of Materials Science, Changchun University of Technology, Changchun, 130012, P. R. China.

# These authors contributed equally to this work.

E-mail: wswjldx2004@163.com

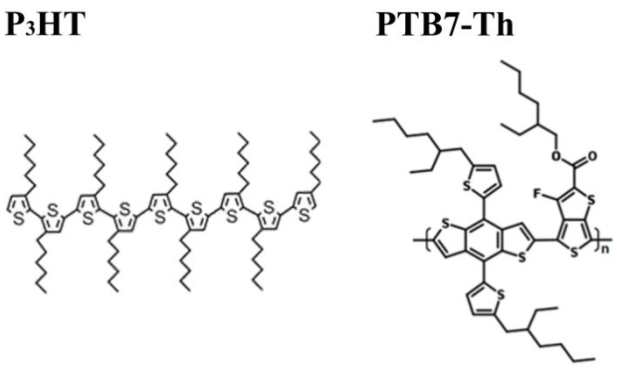

Figure S1 Molecular structure of Poly-3-hexylthiophene (P_3HT) and Poly[4,8-bis(5-(2-ethylhexyl)thiophen-2-yl)benzo[1,2-b;4,5-b']dithiophene-2,6-diyl-alt-(4-(2-ethylhexyl)-3-fluorothieno[3,4-b]thiophene-)-2-carboxylate-2-6-diyl)] (PTB7-Th).

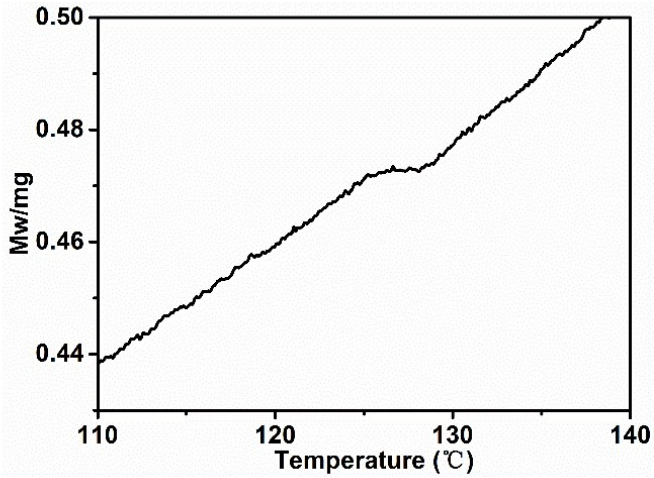

Figure S2 DSC curve of P_3HT. It can be seen from the inflection point in the figure, the glass transition temperature of P_3HT is 130 ℃.

XRD results of different location on the film are shown in Figure S3a. The three points of A0, A1 and A2 on the P_3HT film are located just below the tungsten filament. The electric field strength of different locations on the film in theory: C1=C2＜B1=B2=B3=B4＜A0=A1=A2. As seen in Figure S3b, the intensity of XRD text: C1=C2＞B1≈B2≈B3≈B4＞A0≈A1≈A2. The XRD results are consistent with our expectation.

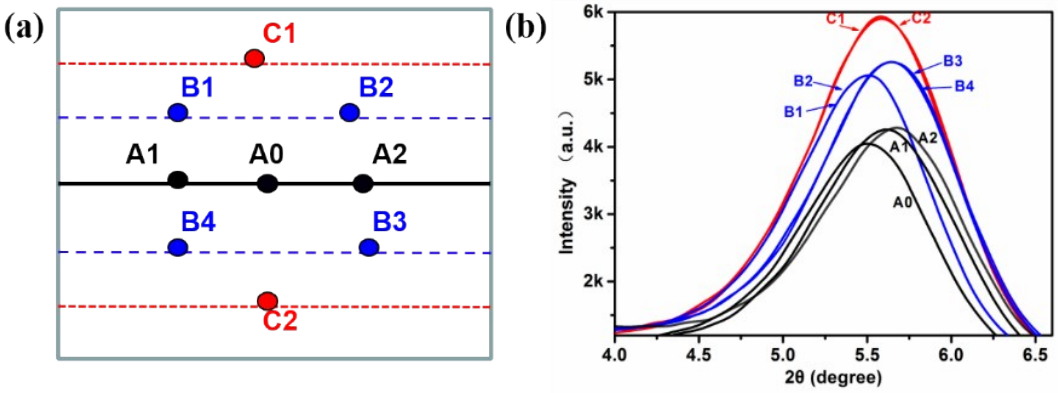

Figure S3 (a) The schematic diagram of the different location on the film; (b) the XRD profiles of the different location on the same P_3HT thin film electric field strength poled under 6 kv cm^{-1}.

In order to confirm the universality of this method, another conjugated polymer (PTB7-Th) was also studied as the object. 10 mg of PTB7-Th was dissolved in 1 ml of chloroform solution by stirring under 60 ℃ for 5 h, then the PTB7-Th films can be achieved by spin-coating at 2000 rpm for 30 s on the indium tin oxide (ITO) substrate, PTB7-Th film was heated to 150 ℃ and electric field poled for at least 30 min, then turned to room temperature under electric field. It can be seen from Figure S4, the absorption intensities of the PTB7-Th films are reduced with the increase of electric field strength.

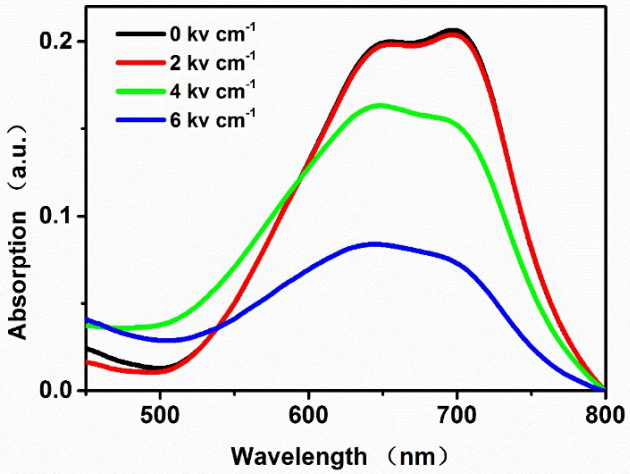

Figure S4 UV-vis absorption spectra of PTB7-Th thin films under different of electric field strengths.

XRD-patterns of PTB7-Th films under different electric field strengths polarized treatment are depicted in Figure S5. The peak at 2θ=24° is reduced with the increase of electric field strength, which obtained the same test result with P_3HT.

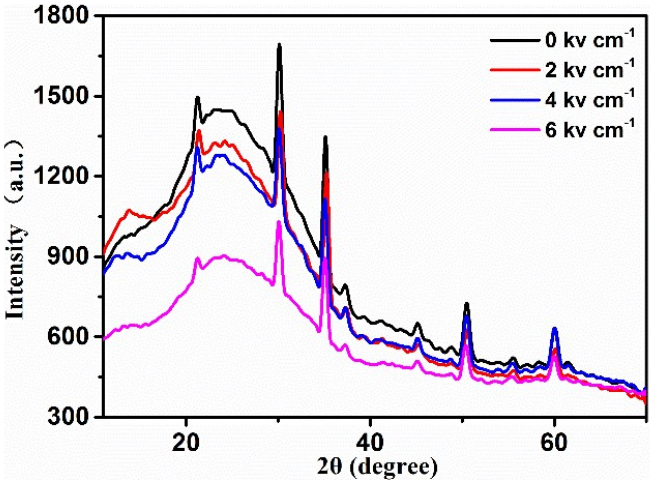

Figure S5 XRD absorption spectra of PTB7-Th thin films under different of electric field strengths.

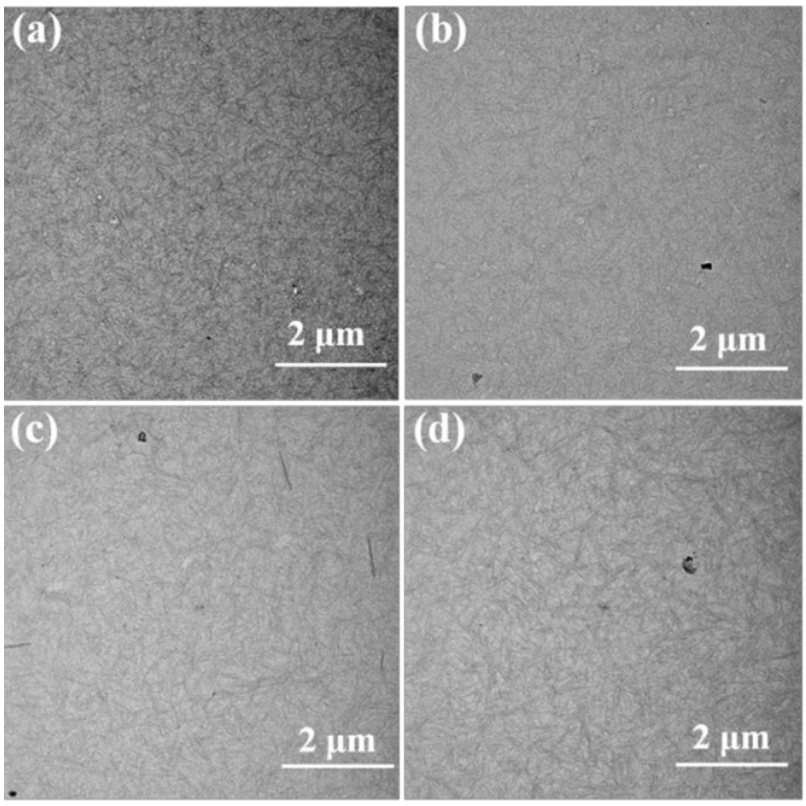

Figure S6 TEM images of P_3HT thin films prepared under different electric field strengths: (a) 0 kv cm^{-1}; (b) E= 2 kv cm^{-1}; (c) E= 4 k v cm^{-1}; (d) E= 6 k v cm^{-1}.

As shown in Figure S6, the O1s peak for the P_3HT films treated by different electric field strengths is attributed to a small amount of oxygen combines with carbon on the alkyl side chain or sulfur on the thiophene ring. However, the content change of oxygen in all samples is irregular, and it is almost unchanged after electric field polarization compared to the sample without electric field treatment. Therefore, it can eliminate the influence of oxygen-containing groups generated by corona polarization on the wettability of P_3HT film surface.

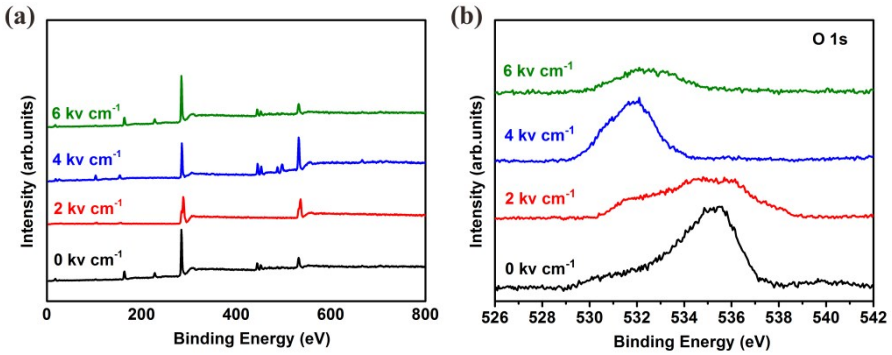

Figure S7 (a) XPS spectra of the P_3HT film under different electric field strengths polarization (0 kv cm^{-1}, 2 kv cm^{-1}, 4 kv cm^{-1}, 6 kv cm^{-1}); and (b) XPS core level spectra of O_{1s} of the P_3HT film under different electric field strengths polarization (0 kv cm^{-1}, 2 kv cm^{-1}, 4 kv cm^{-1}, 6 kv cm^{-1}).