Supporting Information

Deformation Mechanism of Poly(3-alkylthiophene) Studied by *in Situ* X-ray Scattering and Texture Analysis

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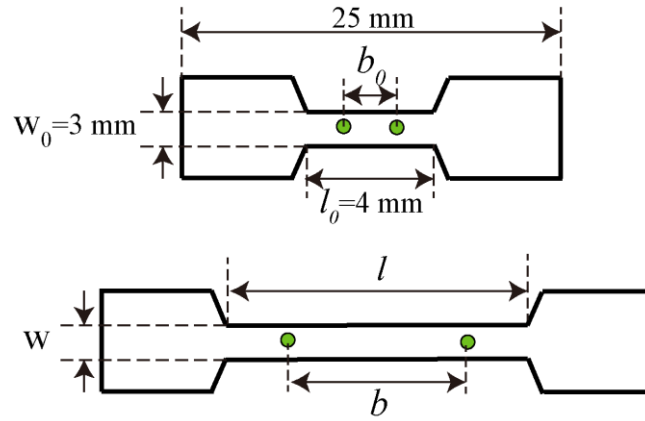
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Figure S1. The dimension and marker points (green circles) on the surface of mini tensile bar before and after stretching.
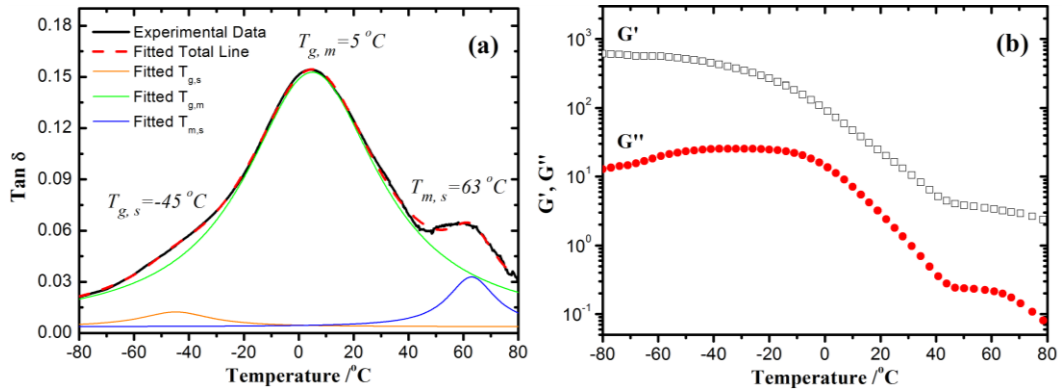

Figure S2. The (a) tan δ and (b) storage modulus (G'), loss storage (G'') of P3DDT film obtained from dynamic mechanical analysis (DMA) measurement. DMA was carried out with a TA Q800 instrument employing uniaxial tension mode. The temperature scan rate was 3 ℃/min and the scan range was -100 ℃ ~ 100 ℃. The dimension of the specimen was 11.90 mm × 5.92 mm × 0.06 mm (length × width × thickness). The frequency was fixed at 1 Hz. A strain of 0.1 % was chosen which was located in the linear viscoelastic regime.
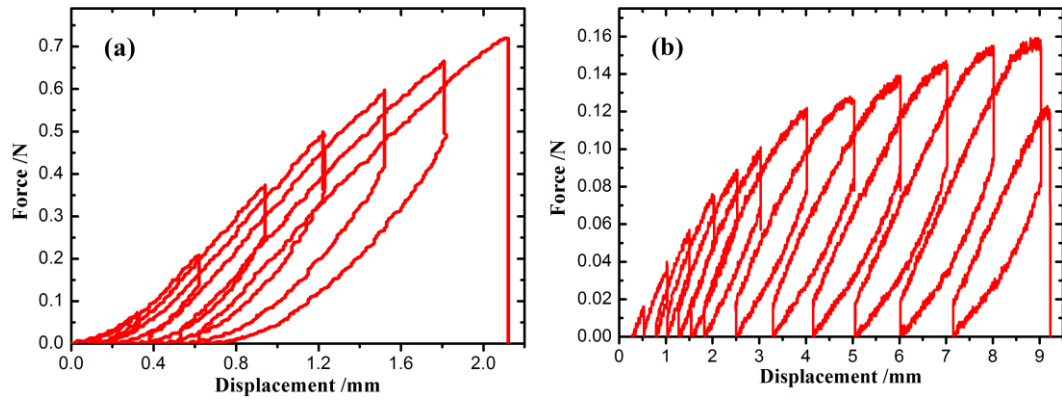
Figure S3. Force-displacement curves of the step-cycle measurements of P3DDT at 30 °C (a) and 110 °C (b), respectively.
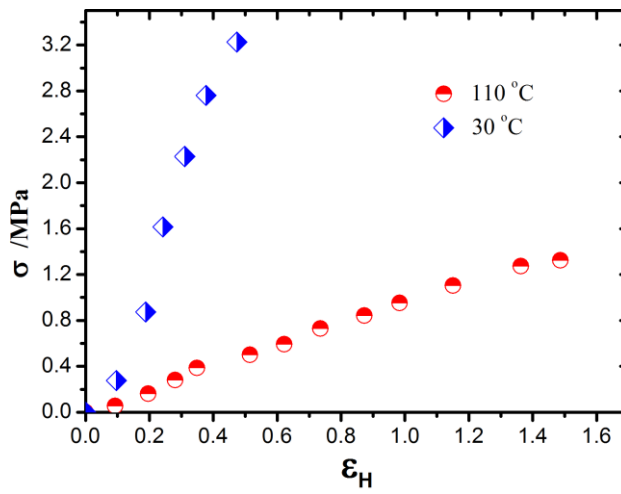

Figure S4. True stress (σ)-strain (ε_H) plots of P3DDT film at 30 °C and 110 °C, respectively.
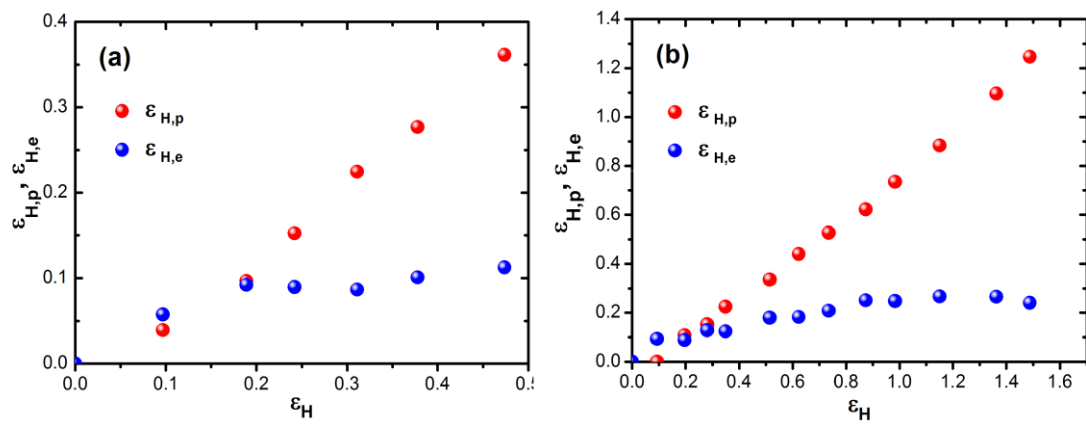

Figure S5. Elastic ($\varepsilon_{H,e}$) and plastic ($\varepsilon_{H,p}$) strain as a function of total strain (ε_H) of P3DDT at (a) 30 °C and (b) 110 °C, respectively.
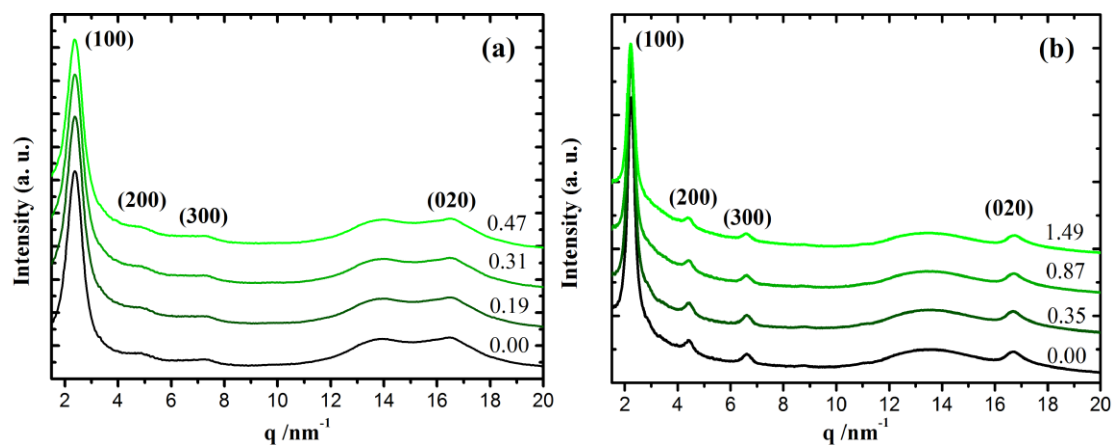
Figure S6. 1D WAXS intensity profiles of P3DDT upon stretching at 30 °C (a) and 110 °C (b), respectively.
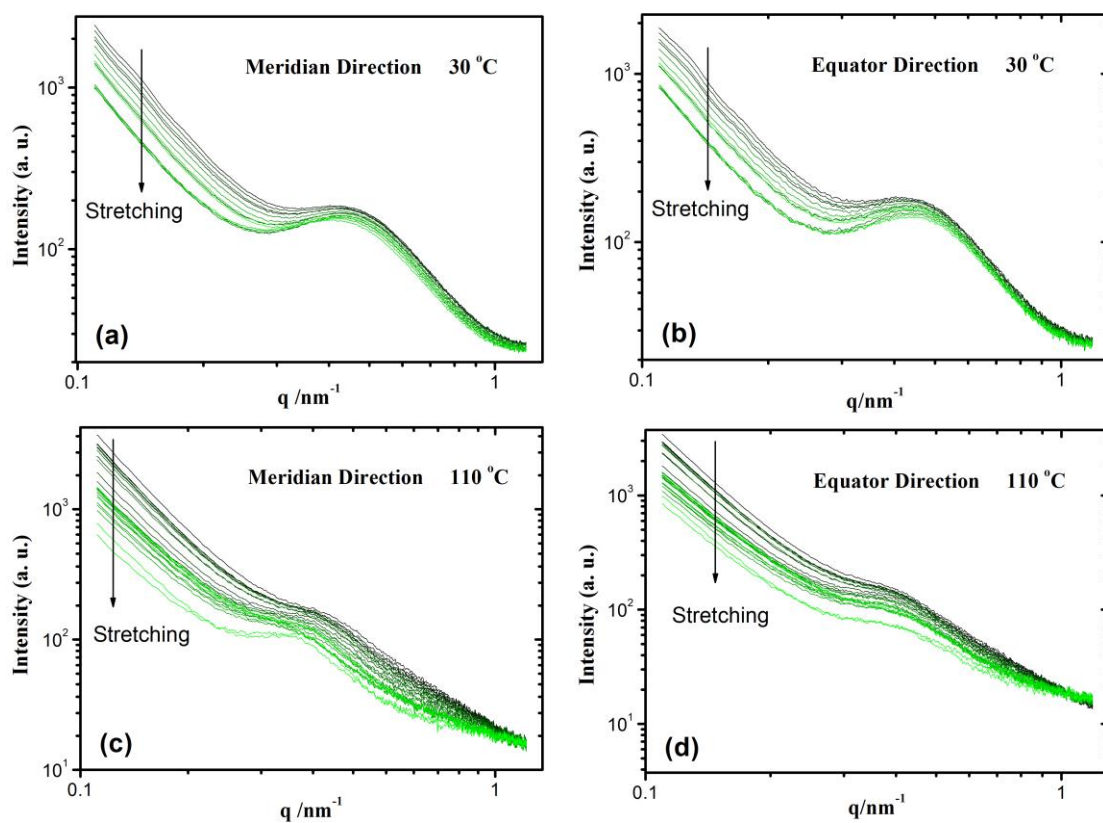

Figure S7. 1D SAXS intensity profiles of P3DDT under uniaxial stretching at 30 °C (a)-(b) and 110 °C (c)-(d).
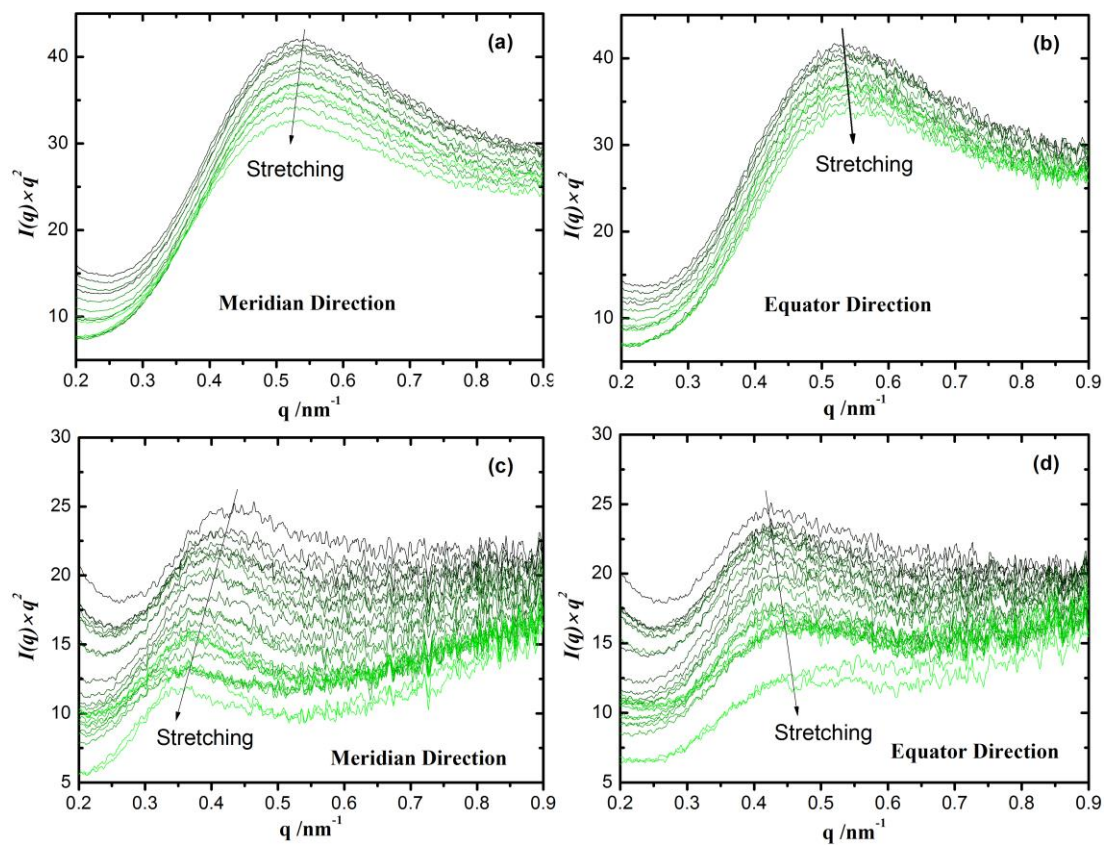
Figure S8. Lorentz corrected SAXS profiles of P3DDT under uniaxial stretching at 30 °C (a)-(b) and 110 °C (c)-(d).
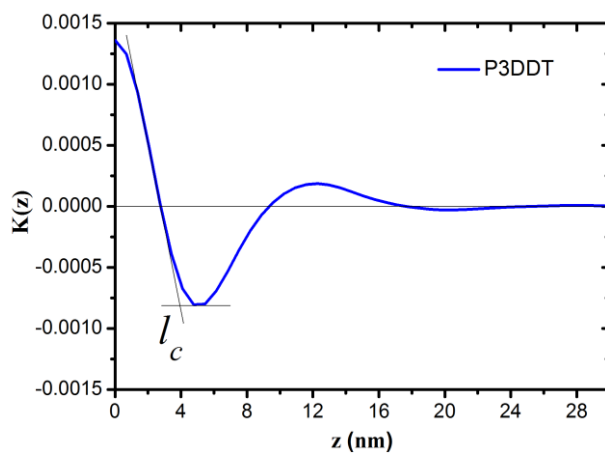

Figure S9. A typical one-dimensional electron density correlation function of unstretched P3DDT at 30 °C. l_c is crystalline layer thickness, which can be estimated from the correlation function curve.
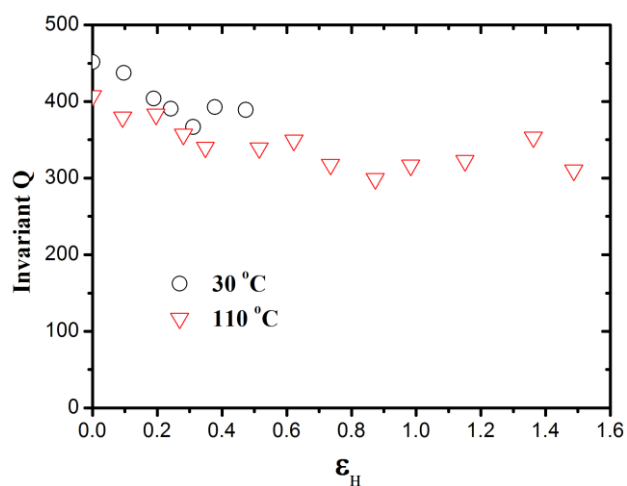
Figure S10. Scattering Invariant Q as a function of true strain (ε_H) at different temperatures.
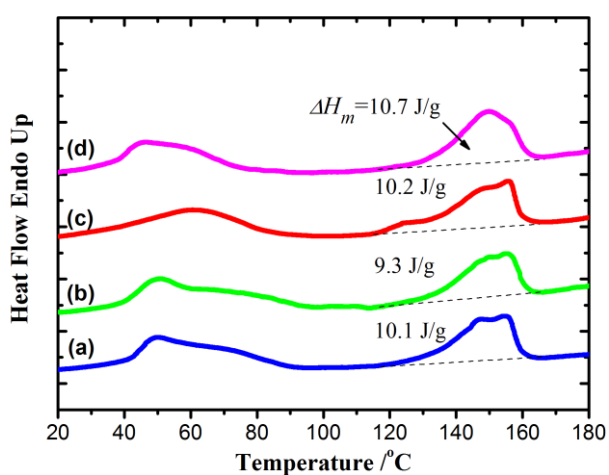

Figure S11. DSC curves of P3DDT before and after stretching. (a) and (c) are annealed at 30 °C and 110 °C for 30 min before stretching, respectively. (b) and (d) are after stretching at 30 °C and 110 °C, respectively. DSC measurements were carried out on a Q2000 DSC (TA Instruments). Temperature scans were performed within the range of 0 °C to 200 °C. Around 4 mg sample were used for measurement. The instrument was calibrated with indium.