The Influence of Air and Temperature on the Performance of PBDB-T and P3HT in Organic Thin Film Transistors

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Supporting Information

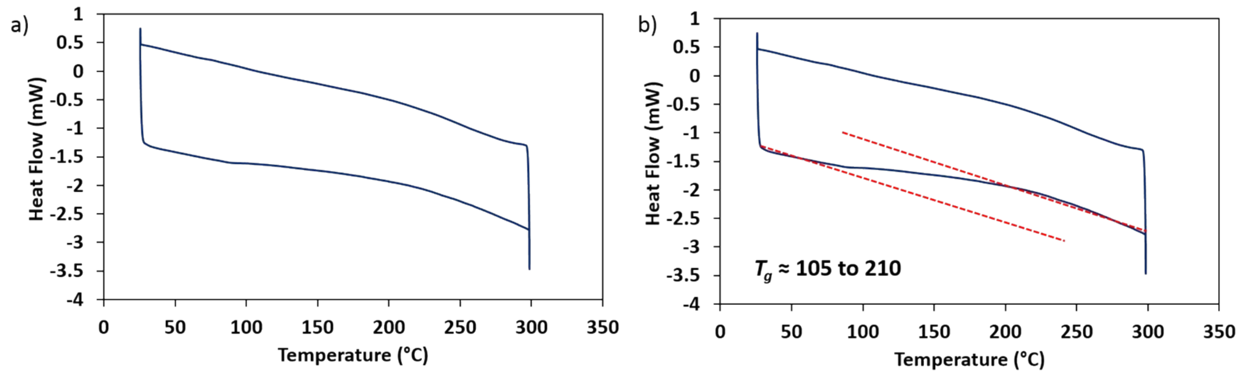

Figure S1. Differential scanning calorimetry of PBDB-T where a) is the 3rd scan of a Heat/Cool/Heat/Cool/Heat/Cool run and b) is the same run with the lines used for experimental determination of the T_g.

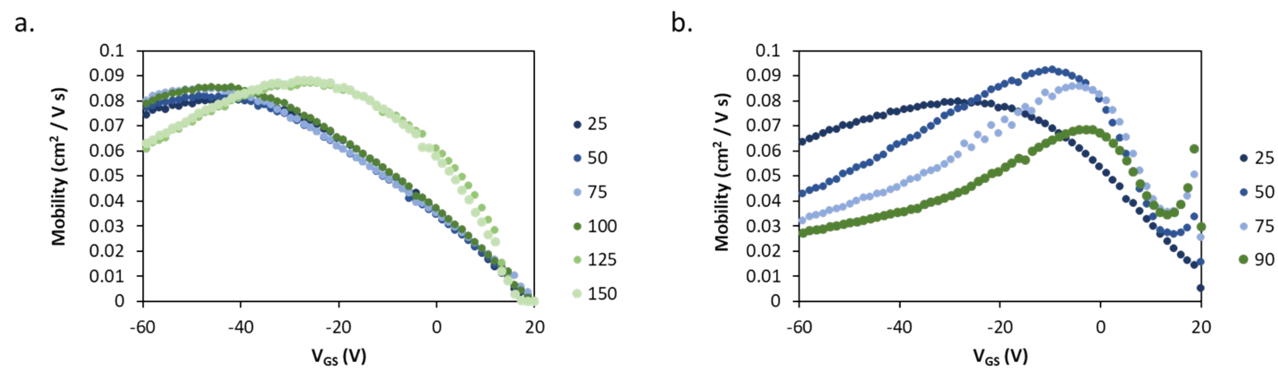

Figure S2. Field-effect mobility (μ_h) for P3HT with respect to the gate-source voltage for a characteristic device at varied temperatures. **a.** Performance in vacuum. **b.** Performance in air. This mobility was calculated between adjacent points in the transfer data.

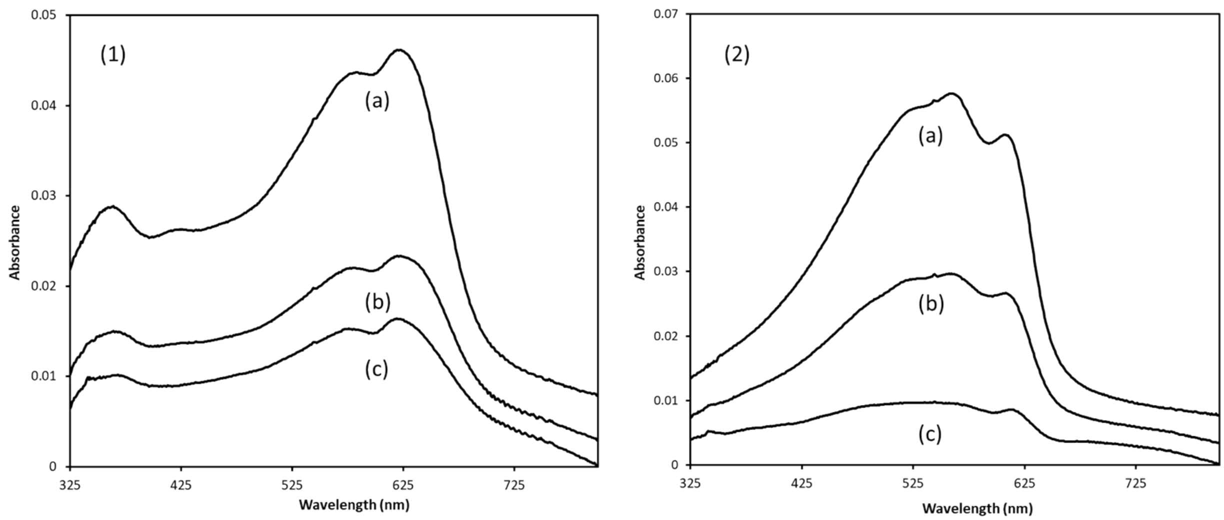

Figure S3. Changes in the UV-visible spectrum of PBDB-T (1) and P3HT (2) thin films during heating at 130 °C: (a) 0 min; (b) 15 min; (c) 30 min. 0.5 mg/mL solutions of P3HT and PBDB-T were drop cast onto glass slides and left to dry in ambient conditions for 2 hours. Sample absorbance was tested for each polymer (a), then the glass slides were heated on a hot plate at 130 °C for 15 minutes (b), at which point the absorbances were tested again. This was repeated to 30 minutes (b).

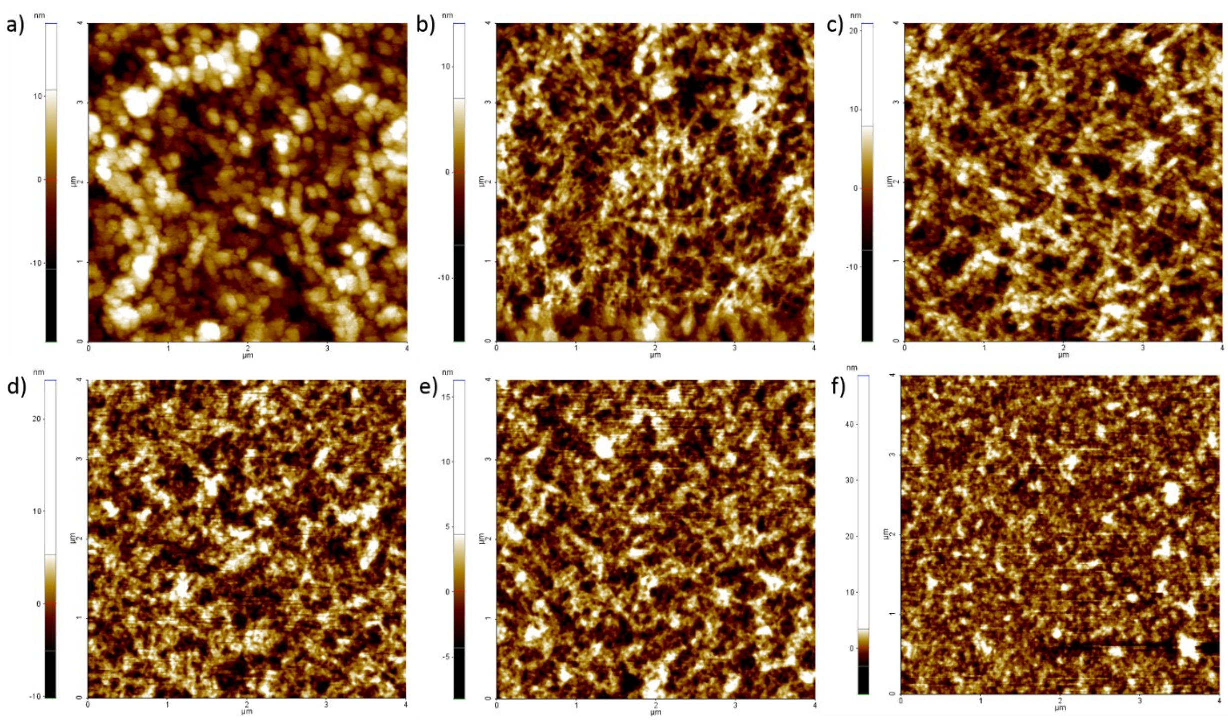

Figure S4. Atomic force microscopy images of P3HT films made with different conditions: **a-c)** drop cast; **d-f)** spin-cast; **a,b)** unannealed; **b,e)** annealed in vacuum; **c,f)** annealed in air.

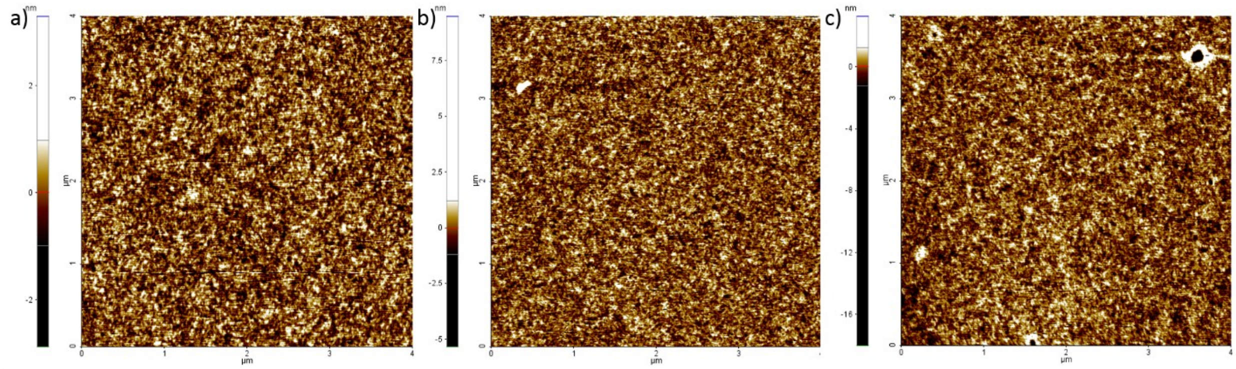

Figure S5. Atomic force microscopy images of spin-cast PBDB-T films made with different conditions: **a)** unannealed; **b)** annealed in vacuum; **c)** annealed in air.

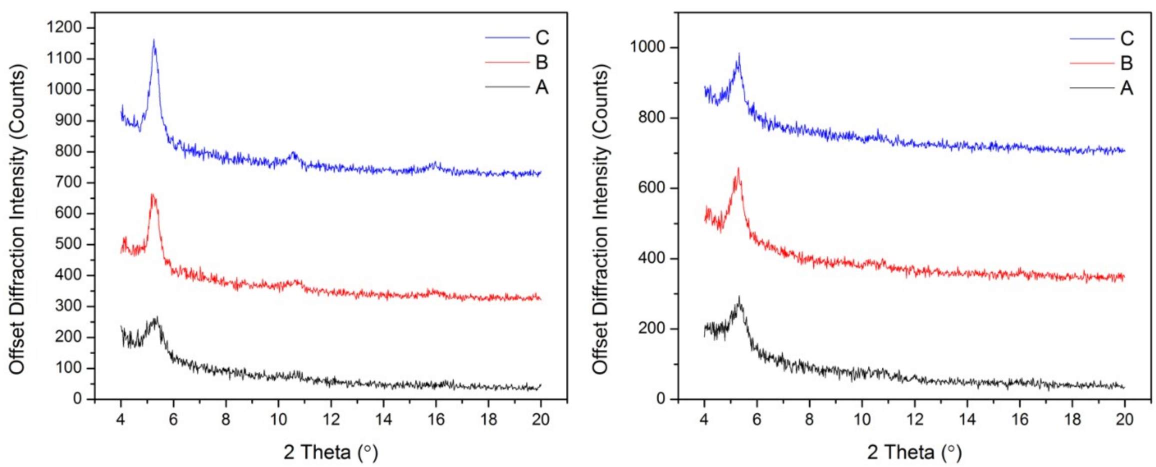

Figure S6: X-ray diffraction pattern for thin films of spin-cast (left) and drop-cast (right) P3HT: A) As cast; B) Annealed at 200 °C in vacuum; C) annealed at 200 °C in air.

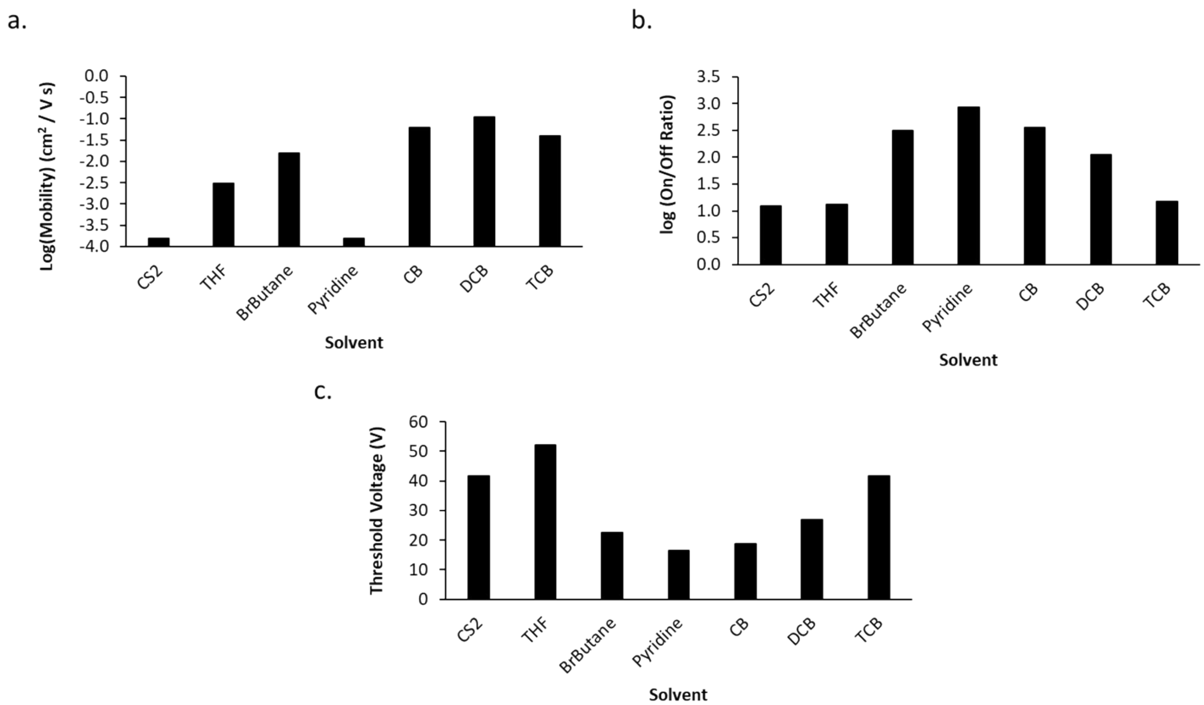

Figure S7. Solvent optimization for P3HT devices drop cast at a concentration of 0.5 mg/mL. **a**. Log of the field-effect mobility (μ_h). **b**. Log of the on/off ratio ($I_{on/off}$). **c**. Threshold voltage (V_T). CS2: carbon disulfide, THF: tetrahydrofuran, BrButane: 1-bromobutane, CB: chlorobenzene, DCB: dichlorobenzene, TCB: trichlorobenzene.

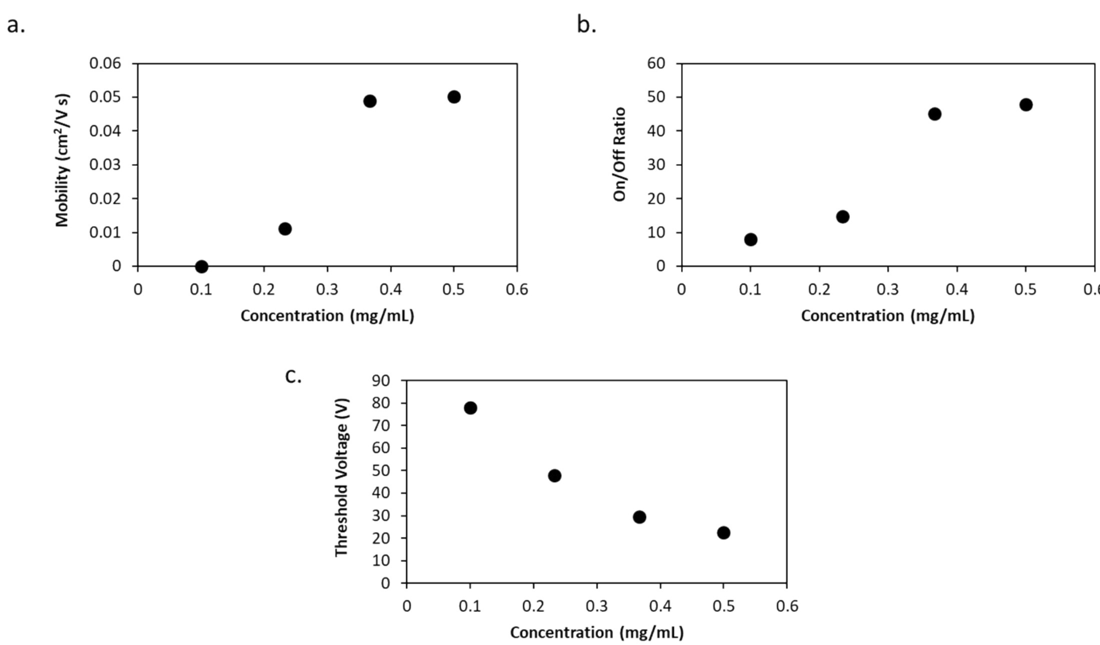

Figure S8. Drop casting concentration optimization with P3HT from 0.1 to 0.5 mg/mL. **a**. Field-effect mobility (μ_h). **b**. On/off ratio ($I_{on/off}$). **c**. Threshold voltage (V_T).

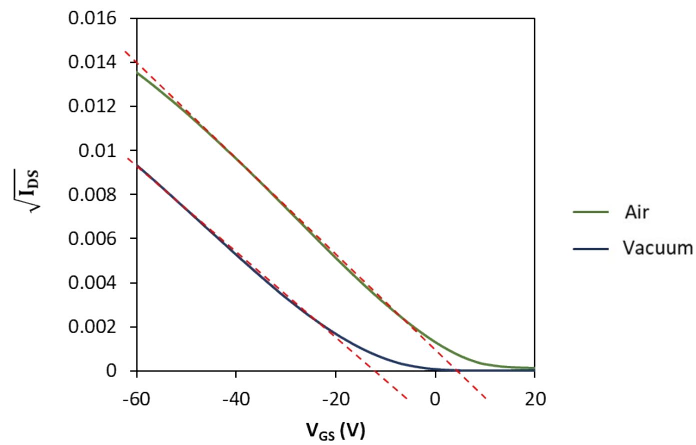

Figure S9: $\sqrt{I_{DS}}$ vs. V_{GS} curves for PBDB-T devices post-anneal that were tested in either air or vacuum for V_{DS} of -70V. The red line indicates the tangent used on the linear region used to calculate the threshold voltage and mobility. The higher mobility in air is evident from the greater slope of the tangent, and the more positive threshold voltage is clear from the x-intercept.