

Supporting Information

Effects of Side Chain on High-temperature Operation Stability of Conjugated Polymers

Dung T. Tran,¹ Aristide Gumyusenge,¹ Xuyi Luo,¹ Michael Roders,² Zhengran Yi,¹

Alexander L. Ayzner,² and Jianguo Mei^{1,}*

¹Department of Chemistry, Purdue University, West Lafayette, Indiana 47907, United States.

²Department of Chemistry and Biochemistry, University of California at Santa Cruz, 1156 High Street, Santa Cruz, California 95064, United States

Corresponding author:

* E-mail: jgmei@purdue.edu

The effective mobility μ_{eff} is calculated from the equation $\mu_{\text{eff}} = r \times \mu^1$ in which r is the reliability factor.

$$r = \left(\frac{\sqrt{|I_{SD}|^{\text{max}}} - \sqrt{|I_{SD}|^0}}{|V_G|^{\text{max}}} \right)^2 \bigg/ \left(\frac{\partial \sqrt{|I_{SD}|}}{\partial V_G} \right)_{\text{claimed}}^2$$

The observed field effect mobility μ is calculated from the equation $I_{DS} = (\mu WC/2L)(V_G - V_T)^2$, in which I_{DS} is the drain-source current, W is the channel width, L is the channel length, C is the capacitance per unit area of the gate dielectric layer, V_G is the gate voltage, V_T is the threshold voltage. V_T is estimated at the intersection of the dash line with the line $I_{DS}=0$, which is demonstrated in Figure S2-S5.

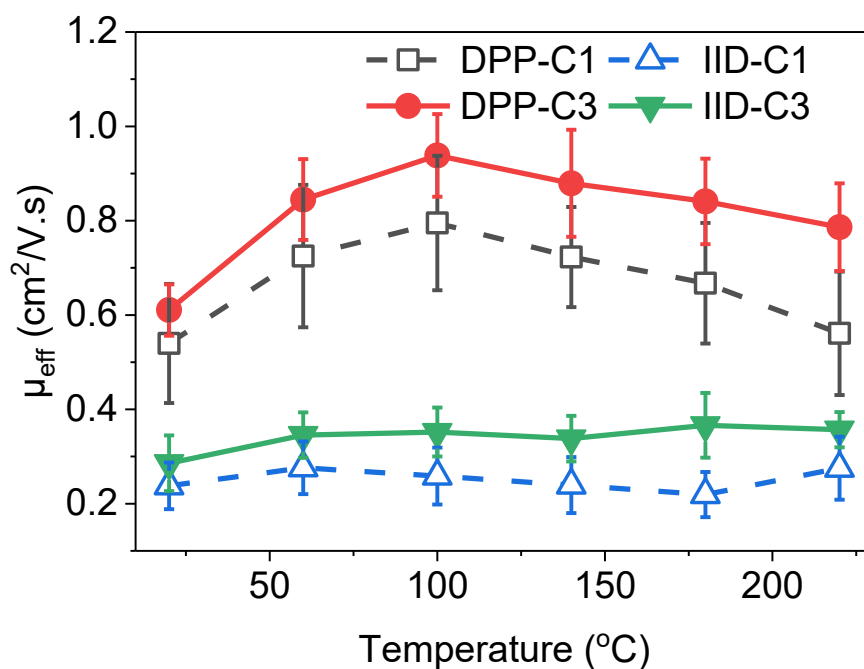


Figure S1: Average effective mobility (μ_{eff}) of all four polymers at different temperatures from 20°C to 220°C

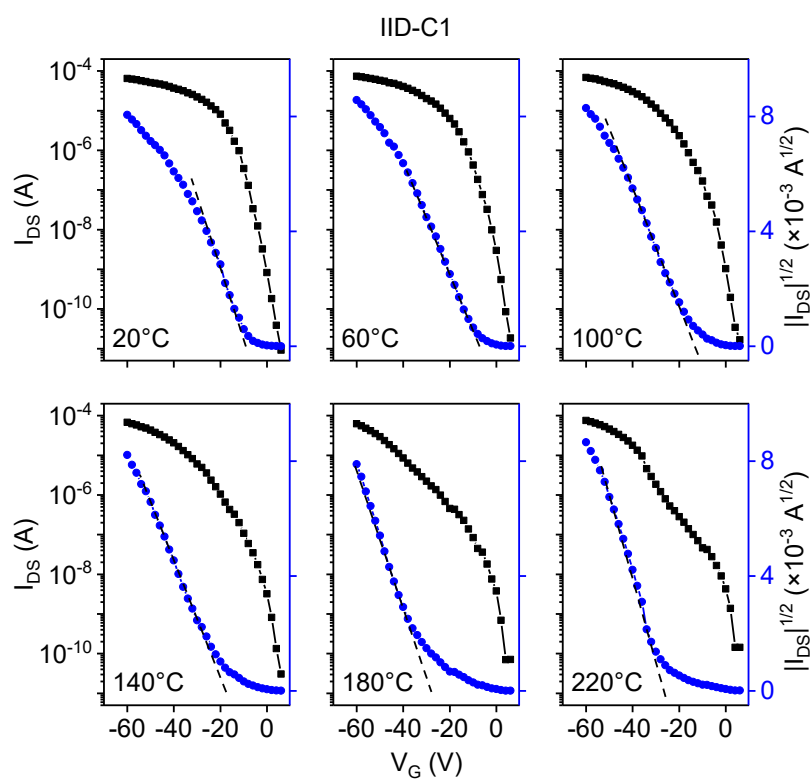


Figure S2: Characteristic transfer curves of IID-C1 at different temperatures.

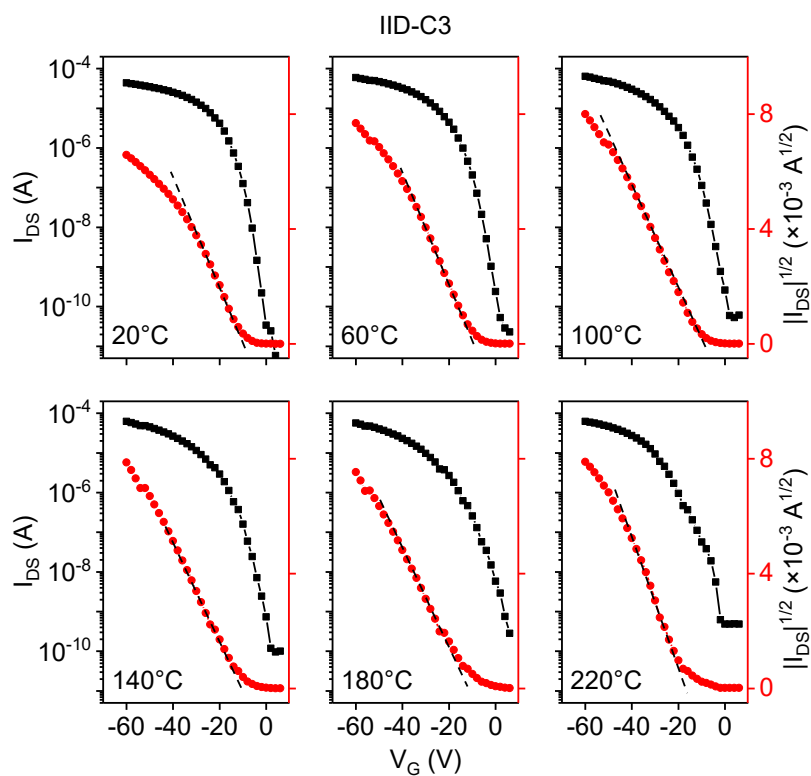


Figure S3: Characteristic transfer curves of IID-C3 at different temperatures.

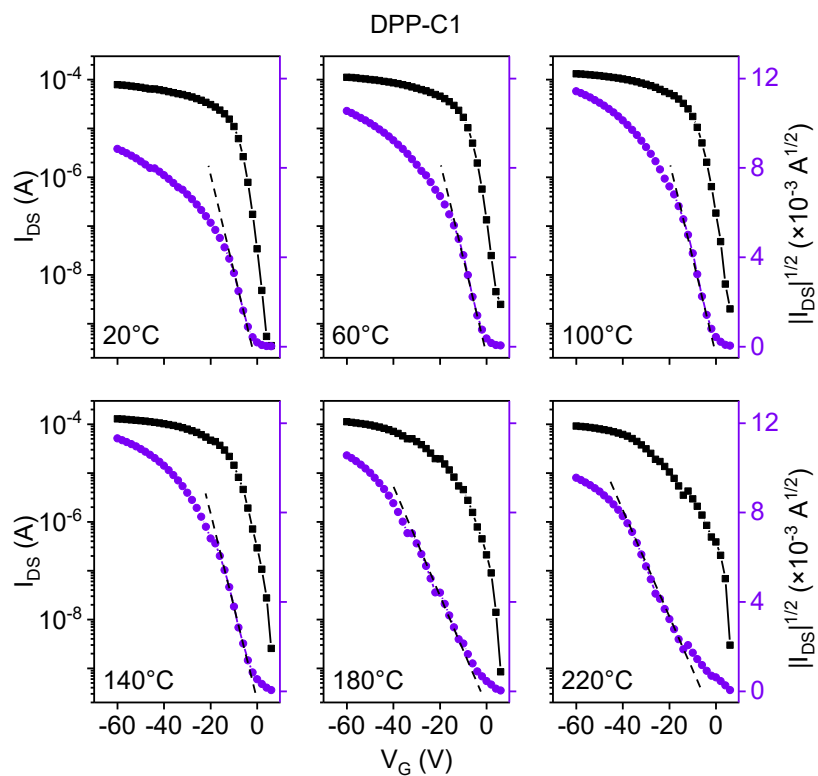


Figure S4: Characteristic transfer curves of DPP-C1 at different temperatures.

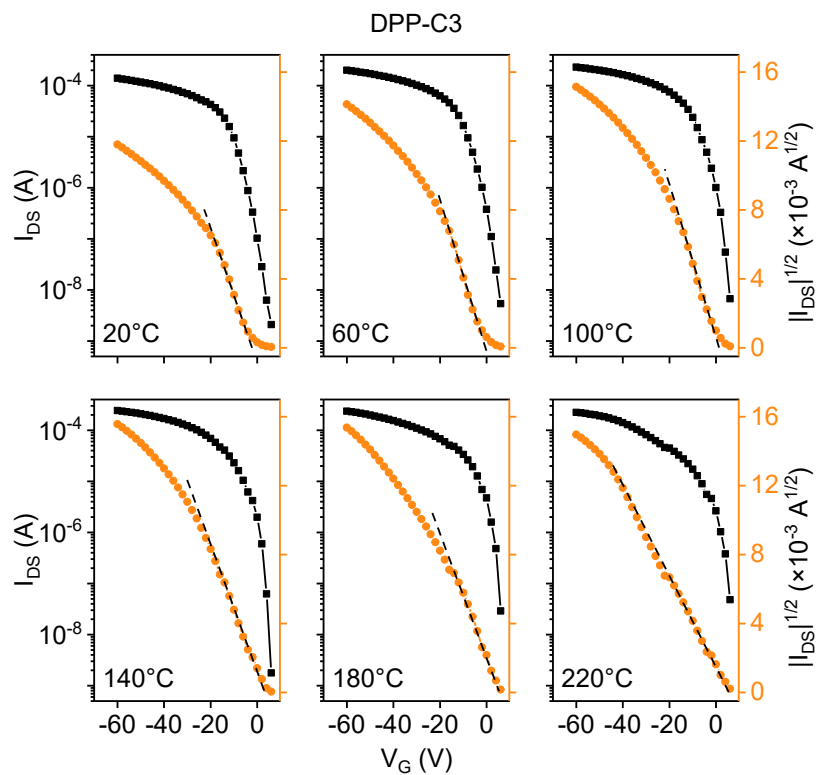


Figure S5: Characteristic transfer curves of DPP-C1 at different temperatures.

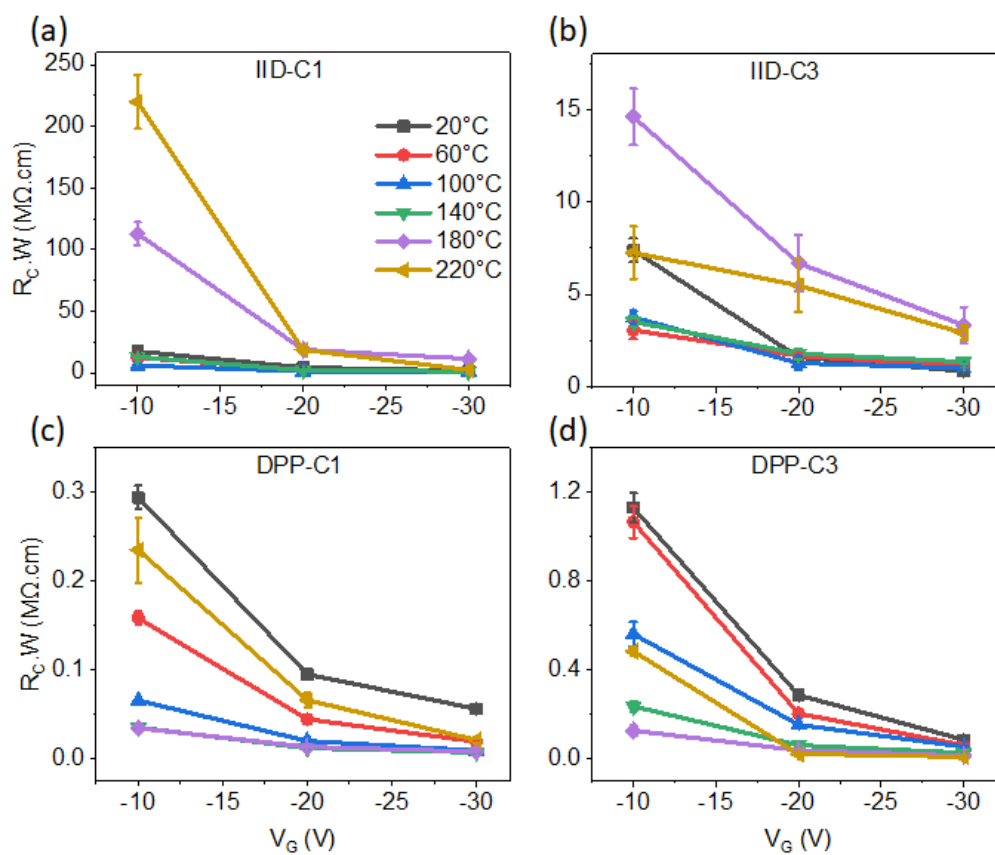


Figure S6: Temperature and gate voltage dependent contact resistance of IID-C1 (a); IID-C3 (b); DPP-C1 (c); and DPP-C3 (d).

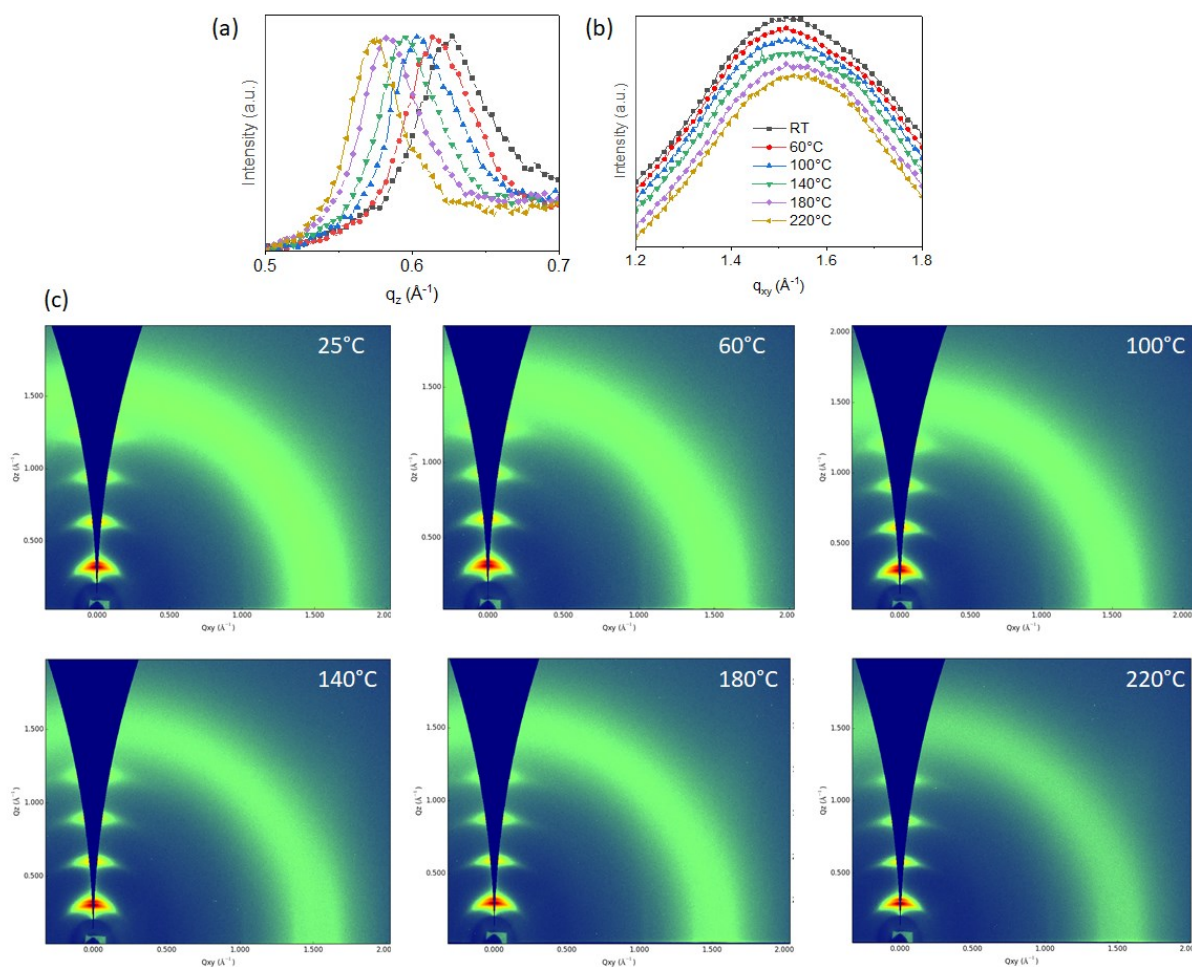


Figure S7: (a) The out-of-plane; (b) in-plane 1D-GIXRD profiles; and (c) 2D-GIXRD patterns of IID-C1 at different temperatures from 25°C to 220°C

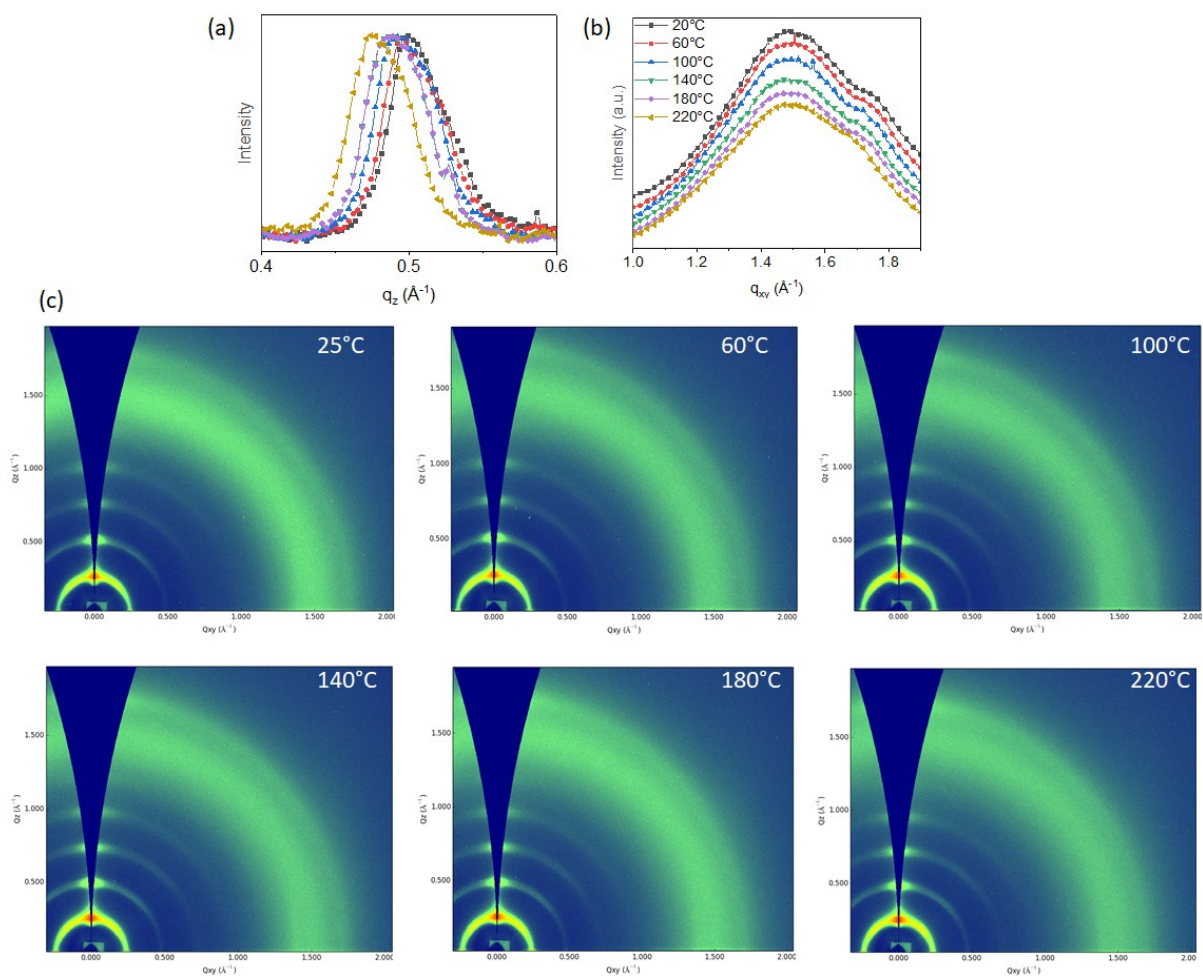


Figure S8: (a) The out-of-plane; (b) in-plane 1D-GIXRD profiles; and (c) 2D-GIXRD patterns of IID-C3 at different temperatures from 25°C to 220°C

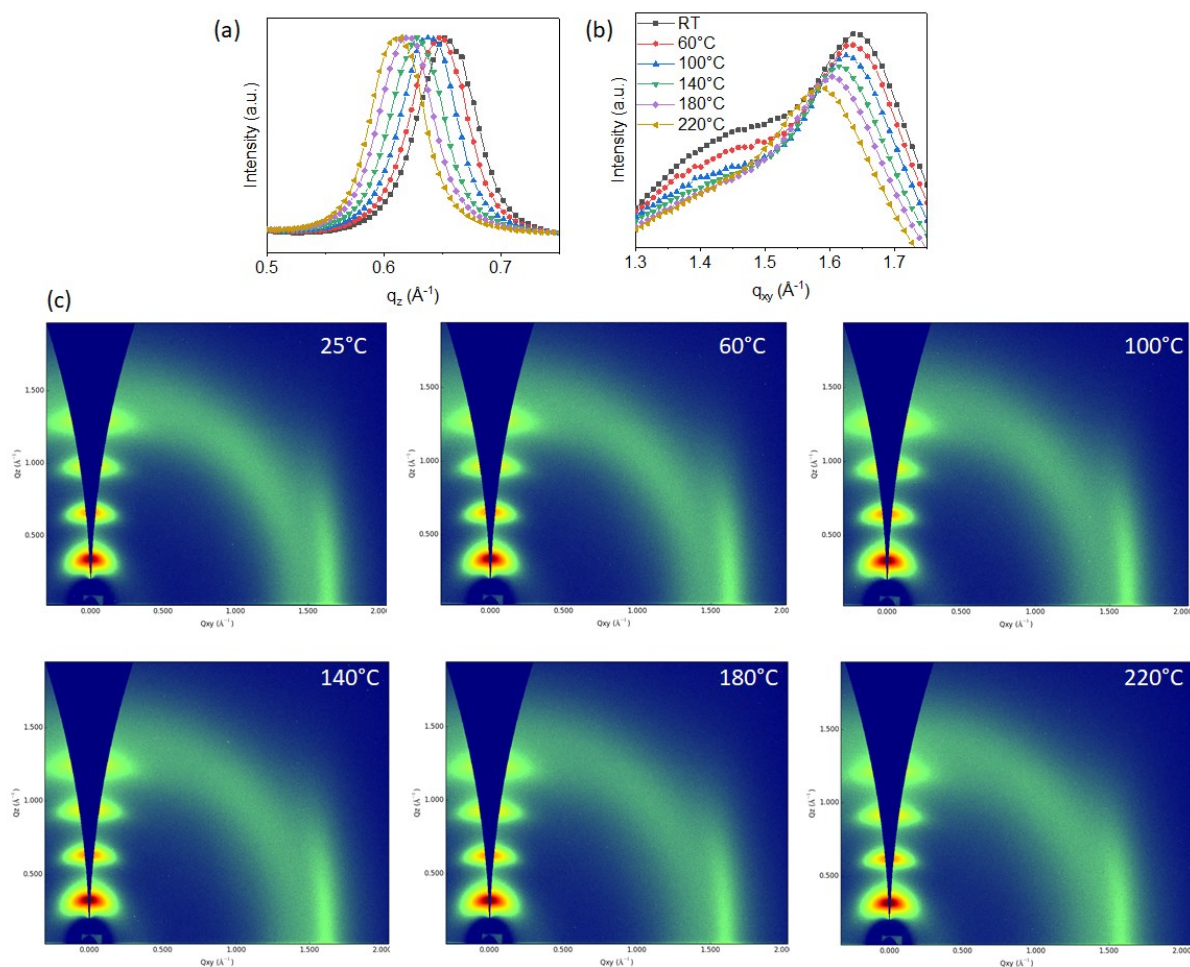


Figure S9: (a) The out-of-plane; (b) in-plane 1D-GIXRD profiles; and (c) 2D-GIXRD patterns of DPP-C1 at different temperatures from 25°C to 220°C

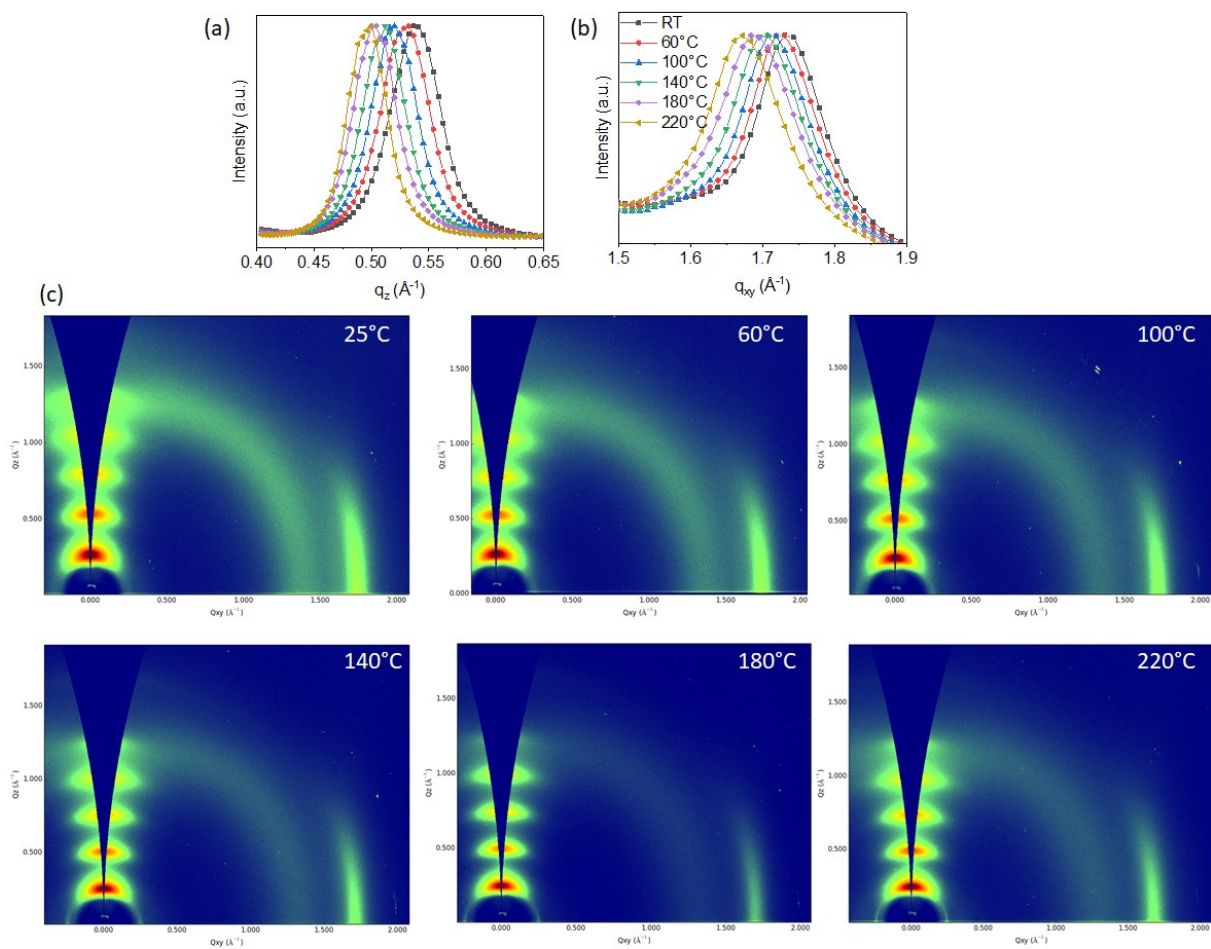


Figure S10: (a) The out-of-plane; (b) in-plane 1D-GIXRD profiles; and (c) 2D-GIXRD patterns of DPP-C3 at different temperatures from 25°C to 220°C

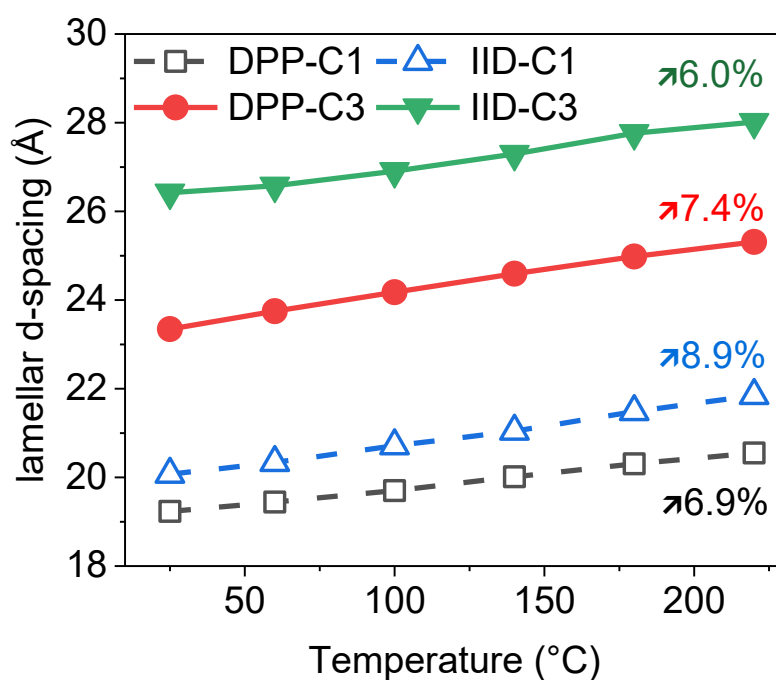


Figure S11: Temperature-dependent lamellar packing distance of four polymers from 25°C to 220°C

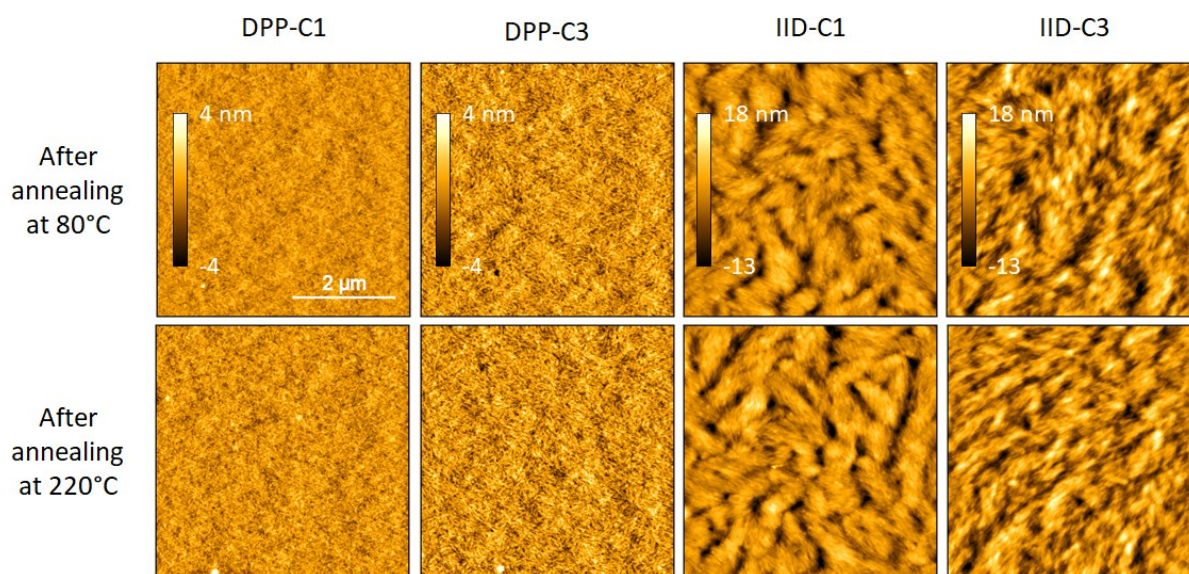


Figure S12: Heating effect on the morphology of IID-based and DPP-based polymers. In all cases, the polymers morphology is quite stable up to 220°C.

References:

- (1) Choi, H. H.; Cho, K.; Frisbie, C. D.; Sirringhaus, H.; Podzorov, V. Critical Assessment of Charge Mobility Extraction in FETs. *Nat. Mater.* **2017**, *17* (1), 2–7.