

Synthesis of Fluorinated Analogues of a Practical Polymer TQ for Improved Open-Circuit Voltages in Polymer Solar Cells

Gitish K. Dutta,^{‡a} Taehyo Kim,^{‡a} Hyosung Choi,^a Junghoon Lee,^a Dong Suk Kim,^b Jin Young Kim^{*a} and Changduk Yang^{*a}

^aInterdisciplinary School of Green Energy, KIER-UNIST Advanced Center for Energy, Low Dimensional Carbon Materials Center Ulsan National Institute of Science and Technology (UNIST), 100 Banyeon-ri, Eonyang-eup, Ulju-gun, Ulsan, 689-798 (Korea).

^bKIER-UNIST Advanced Center for Energy, Korea Institute of Energy Research, Ulsan 689-798, (Korea)

‡These authors contributed equally.

E-mail: yang@unist.ac.kr; jykim@unist.ac.kr.

Fax: +82-52-217-2909;

Tel: +82-52-217-2920

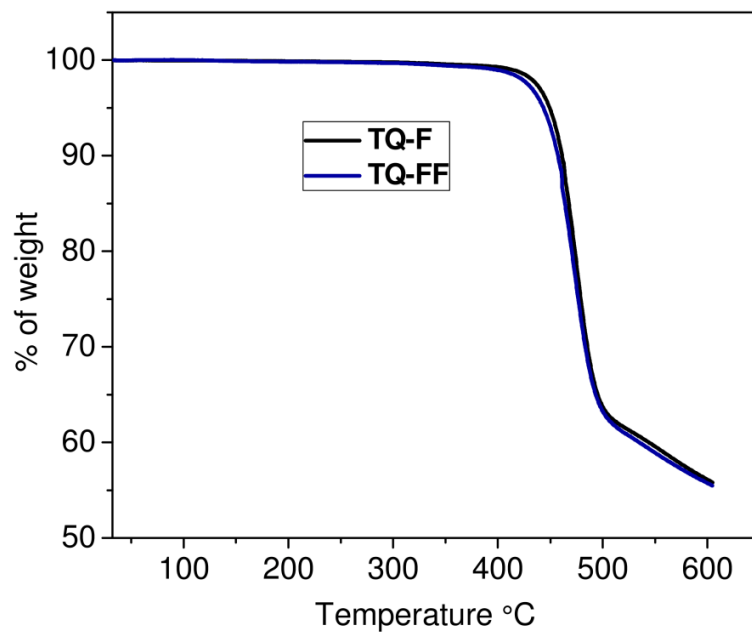


Figure S1. TGA plots of **TQ-F** and **TQ-FF** with a heating rate of $10\text{ }^{\circ}\text{C min}^{-1}$ in N_2 atmosphere.

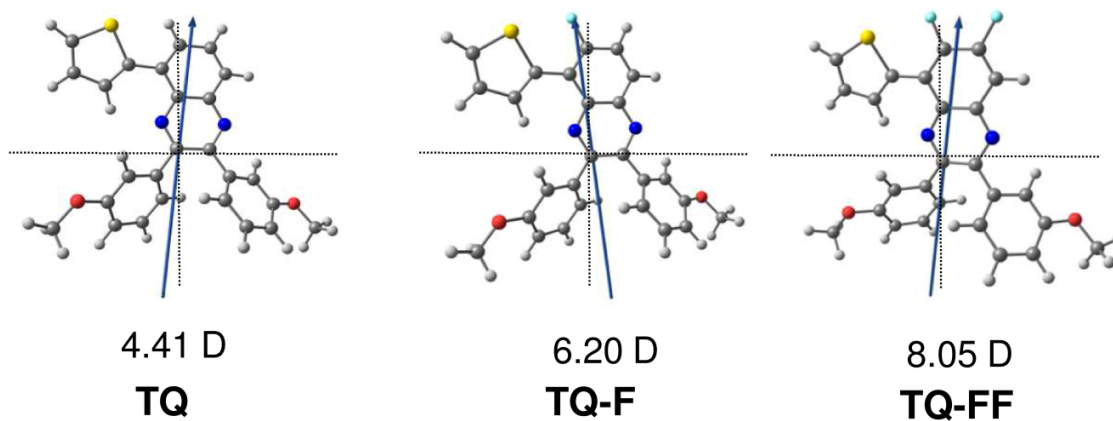


Figure S2. Calculated dipole moment and direction for the single repeating units for TQ-based polymers

Table S1. Summary of photovoltaic parameters of **TQ-F:PC₇₁BM** and **TQ-FF:PC₇₁BM**, respectively with different weight ratios.

BHJ active layer	ratio (w/w)	J_{SC} (mA/cm ²)	V_{OC} (V)	FF	η (%)
TQ-F:PC ₇₁ BM	1:1	8.33	0.94	0.51	3.99
	1:1.5	9.10	0.95	0.51	4.41
	1:2	9.41	0.90	0.45	3.81
	1:3	6.73	0.93	0.54	3.38
TQ-FF:PC ₇₁ BM	1:1	3.25	0.99	0.35	1.12
	1:1.5	3.59	1.00	0.40	1.45
	1:2	3.05	0.95	0.42	1.22
	1:3	2.92	0.98	0.37	1.06

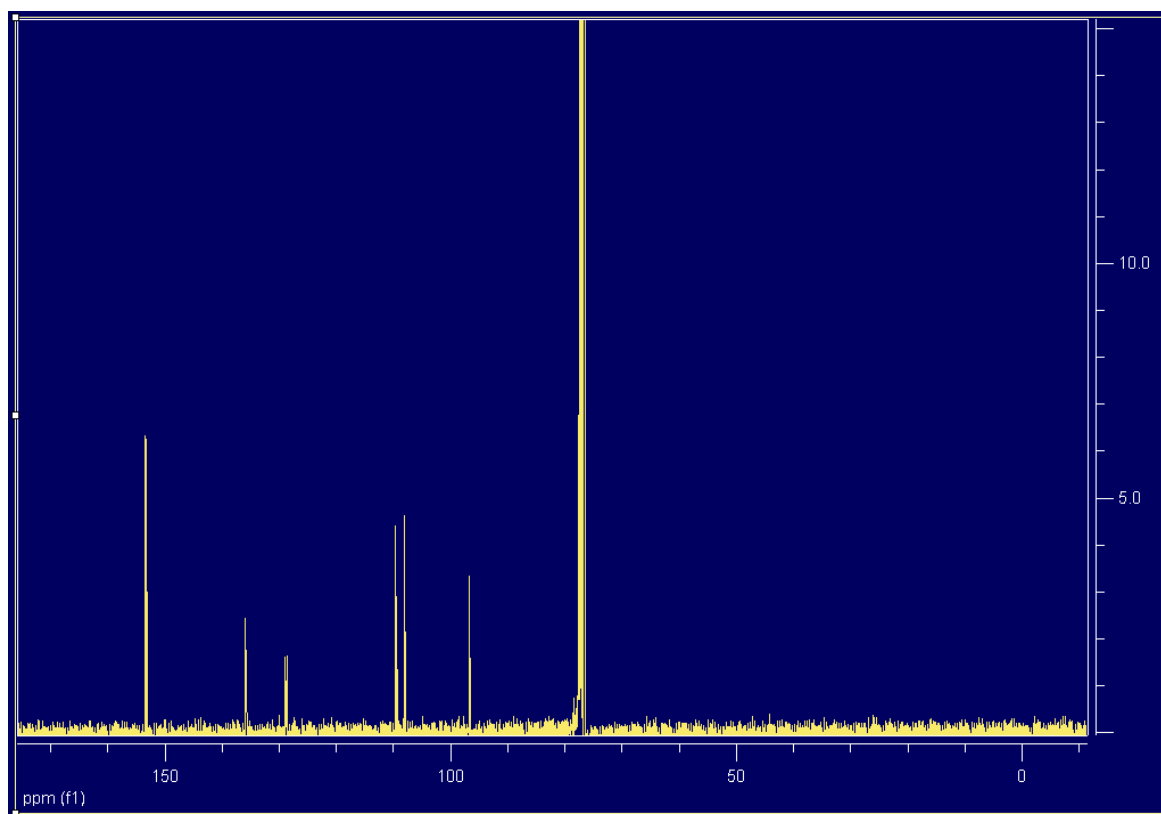


Figure S3. ¹⁹F-decoupled ¹³C NMR spectrum of 3,6-dibromo-4-fluoro-1,2-phenylenediamine (**2a**)