Supporting Information

Polypyridi-nophane Thin Films via CVD process for Pol-ymeric Dielec-tric Layer on Ox-ide TFT with Ul-tra-high Dielec-tric Constant

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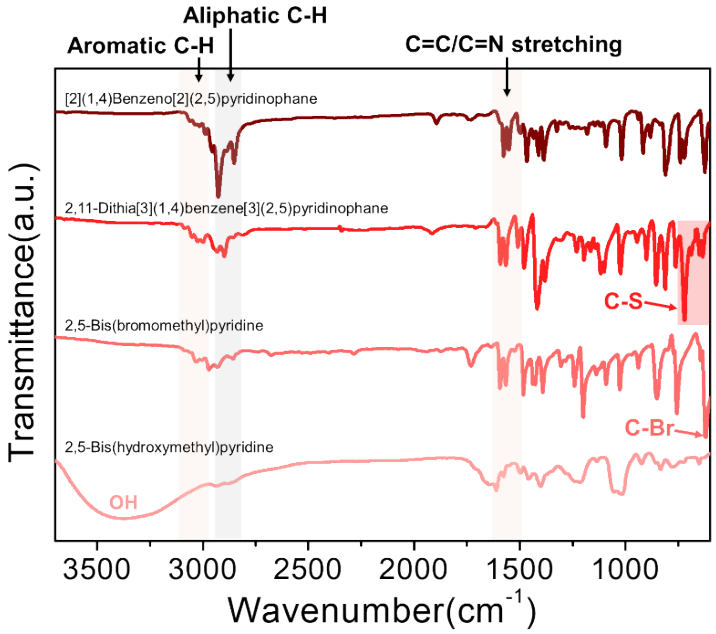
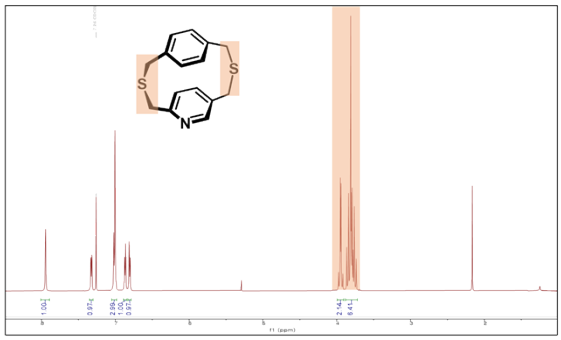
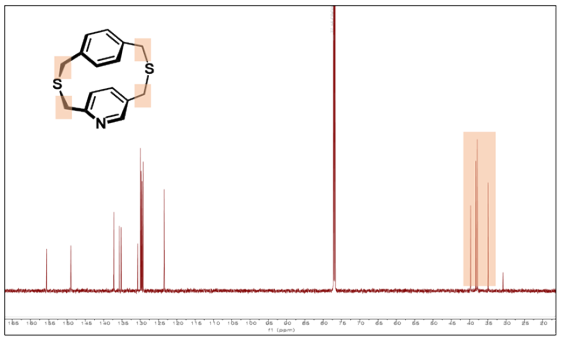


Figure S1. FT-IR spectrum of all synthetic step dimers

(a)

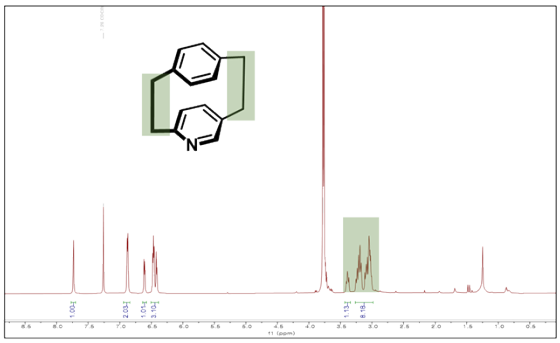


^{1}H NMR (600 MHz, $CDCl_3$) δ 7.94 (d, *J* = 2.3 Hz, 1H), 7.33 (dd, *J* = 8.1, 2.3 Hz, 1H), 7.01 (d, *J* = 10.9 Hz, 3H), 6.87 (d, *J* = 7.7 Hz, 1H), 6.81 (d, *J* = 7.8 Hz, 1H), 3.99 – 3.90 (m, 2H), 3.88 – 3.72 (m, 6H).

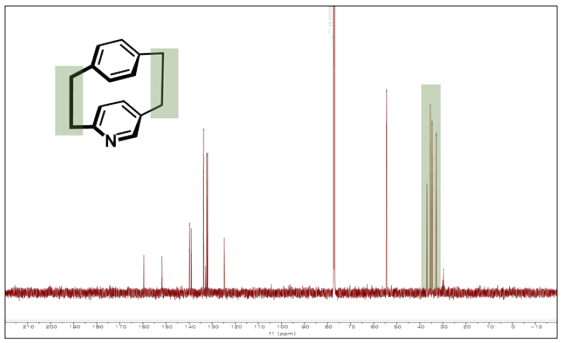


^{13}C NMR (151 MHz, $CDCl_3$) δ 155.60, 148.95, 137.21, 135.76, 135.22, 130.70, 129.94, 129.74, 129.49, 129.19, 123.47, 39.73, 38.31, 37.92, 34.93, 30.85.

(b)



^{1}H NMR (600 MHz, $CDCl_3$) δ 7.73 (s, 1H), 6.88 (d, *J* = 7.7 Hz, 2H), 6.61 (d, *J* = 7.8 Hz, 1H), 6.50 – 6.38 (m, 3H), 3.39 (t, *J* = 12.1 Hz, 1H), 3.27 – 2.99 (m, 8H).



^{13}C NMR (151 MHz, $CDCl_3$) δ 159.56, 151.82, 139.85, 139.73, 139.04, 133.75, 133.69, 132.94, 132.37, 131.87, 124.78, 54.48, 54.44, 36.94, 35.51, 34.74, 32.93.

Figure S2. ^{1}H-NMR and ^{13}C-NMR spectrum of dimer (a) (rac)-2,11-Dithia[3](1,4)benzene[3]-(2,5)pyridinophane (Dithia-PyP) (b) (rac)-[2](1,4)benzene[2](2,5)pyridinophan (PyP)

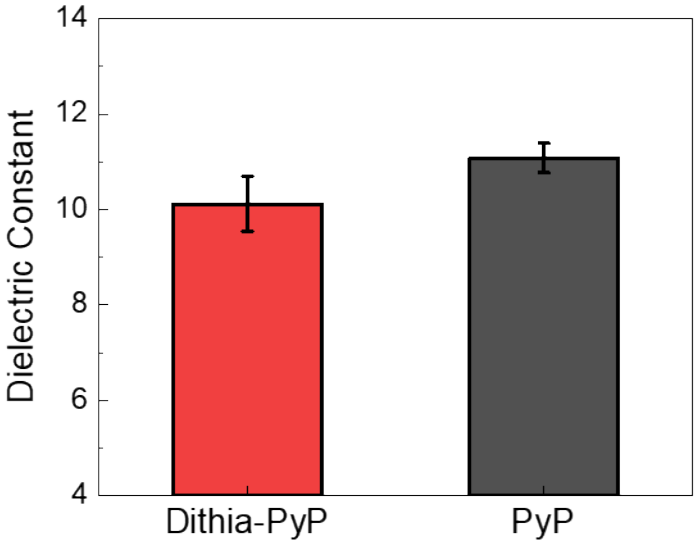


Fig. S3. Statistical distribution of dielectric constants extracted from nine MIM capacitors. Average dielectric constants of 10.12 ± 0.58 and 11.08 ± 0.31 were obtained for the Dithia-PyP and PyP dielectric films, respectively. The error bars represent the standard deviation calculated from nine devices.

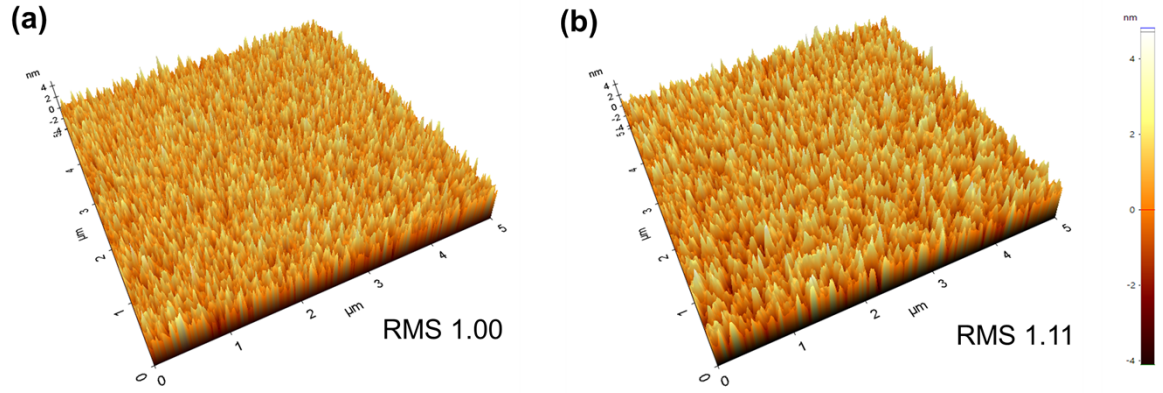


Figure S4. AFM images of each polymer on Si wafer with 50 nm thickness (a) Dithia-PyP and (b) PyP.