Electronic Supplementary Material (ESI) for Polymer Chemistry.

Electrochemical property of anthraquinone-containing polymer nanocomposite by nano-level molecular ordering

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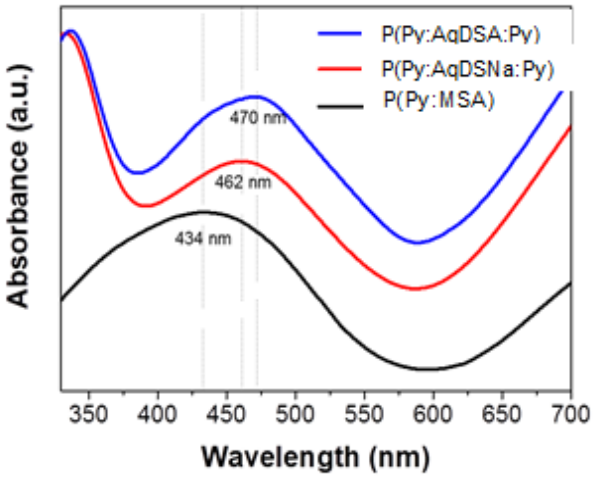


Fig. S1 UV-Vis spectra of PPy-based polymer films. The polymer films were *in situ* coated on the glass substrates during polymerization. The absorption spectra at around 450 nm indicates the existence of p-doped PPy structures. All spectra exhibited absorption peaks at around 450 nm due to a polaron band of p-doped PPy structure.[1] P(Py:AqDSA:Py) showed also the absorption peak of anthraquinone moiety at approximately 340 nm.[2] It proves the coexistence of PPy and AqDSA structures together. The P(Py:AqDSA:Py) is confirmed the redshifted absorption spectra compared with that of P(Py:MSA) because of an electronic interaction between the regularly stacked polymer chains with aromatic anthraquinone compounds.

(1) Ullah, H., Shah, A.-H. A., Bilal, S. & Ayub, K. *J. Phys. Chem. C*, 2014, **118,** 17819–17830.

(2) Jacobsen, M. F., Ferapontova, E. E. & Gothelf, K. V. *Org. Biomol. Chem.* 2009, **7,** 905–908.

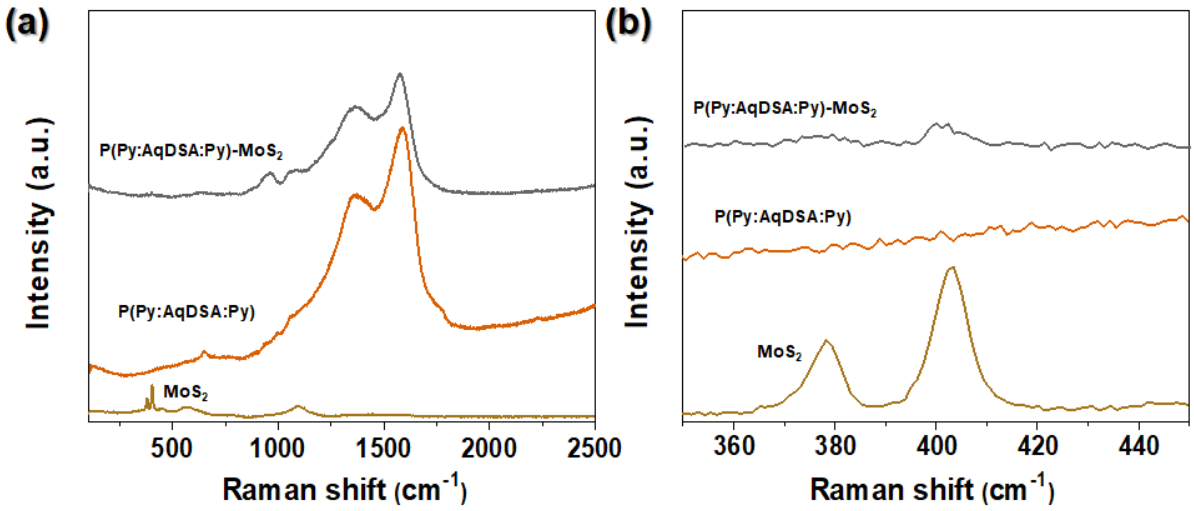


Fig. S2 Raman spectroscopy of composite, P(Py:AqDSA:Py)-MoS_2, P(Py:AqDSA:Py) and MoS_2 range (a) from 350 to 2500 cm^{-1} and (b) from 350 to 450 cm^{-1}.

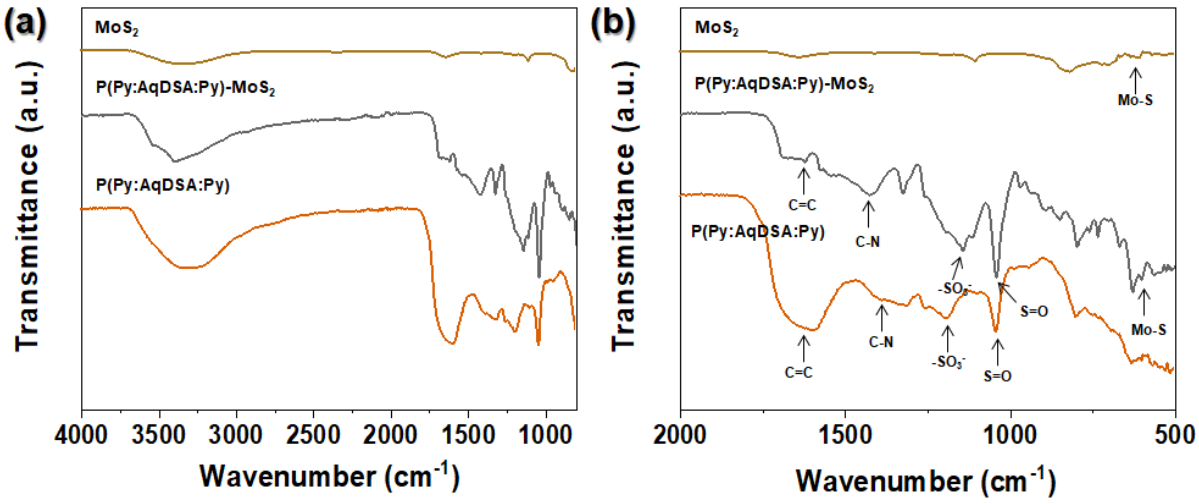


Fig. S3 FT-IR spectroscopy of composites, P(Py:AqDSA:Py)-MoS_2, P(Py:AqDSA:Py) and MoS_2 range (a) from 750 to 4000 cm^{-1} and (b) from 500 to 2000 cm^{-1}.

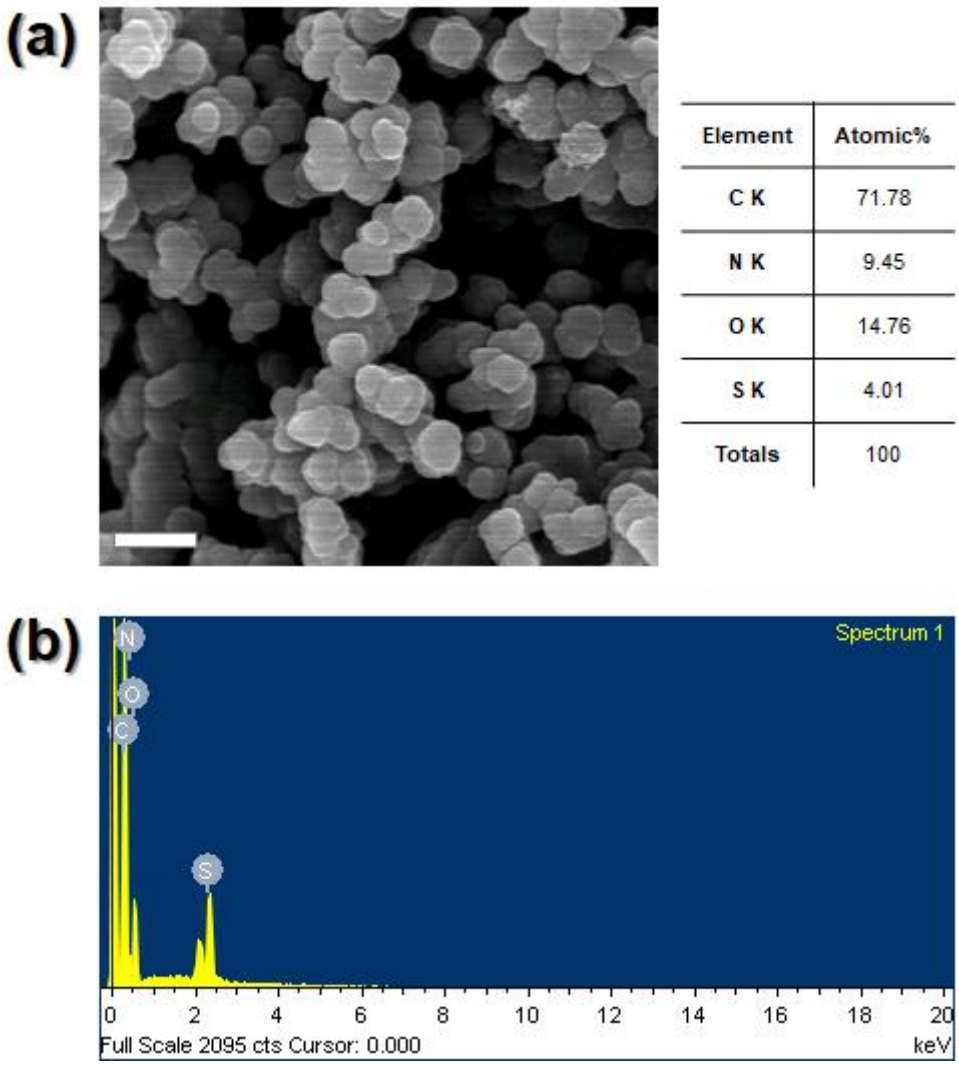
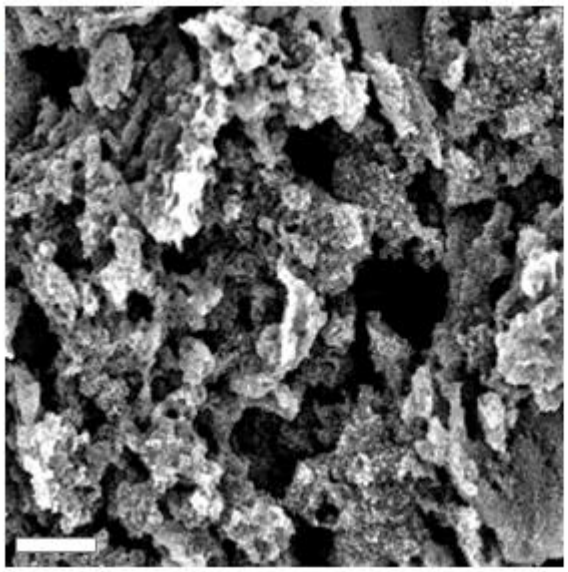


Fig. S4 (a) SEM image, scale bar, 1 μm, and (b) EDS of P(Py:AqDSA:Py).

(a)



Element	Atomic%
C K	45.17
N K	6.11
O K	37.46
S K	5.18
Mo L	6.08
Totals	100

(b)

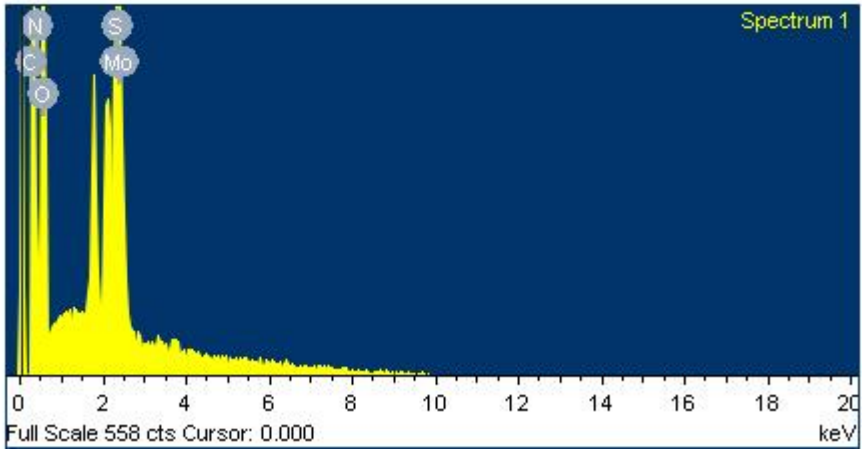


Fig. S5 (a) SEM image, scale bar, 1 μm, and (b) EDS of P(Py:AqDSA:Py)-MoS_2.

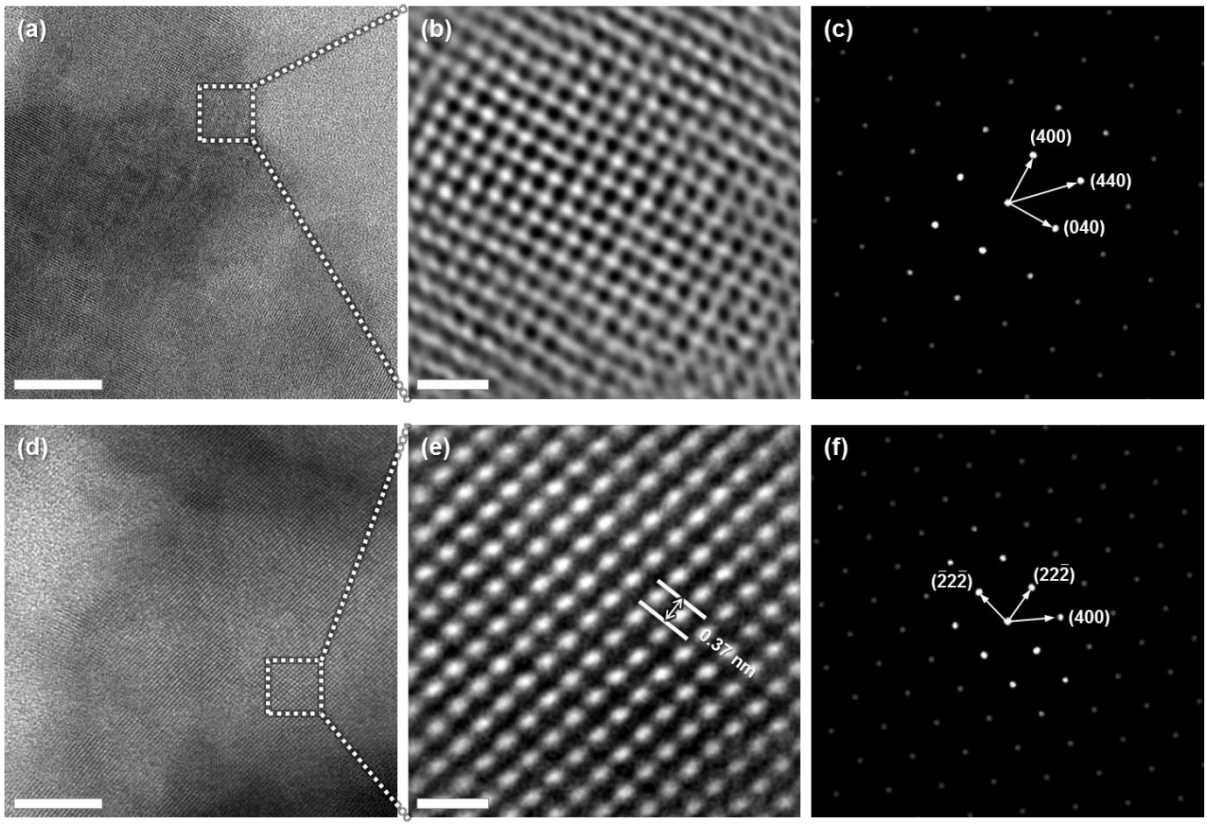


Fig. S6 Crystal morphology of nano level ordered P(Py:AqDSA:Py). HRTEM and processed FFT images observed. (a), (b), (c) [001] and (d), (e), (f) [011] Scale bar, (a), (d) 5 nm and (b), (e) 1 nm. The lattices and their FFT pattern images correspond to the FCC structure.

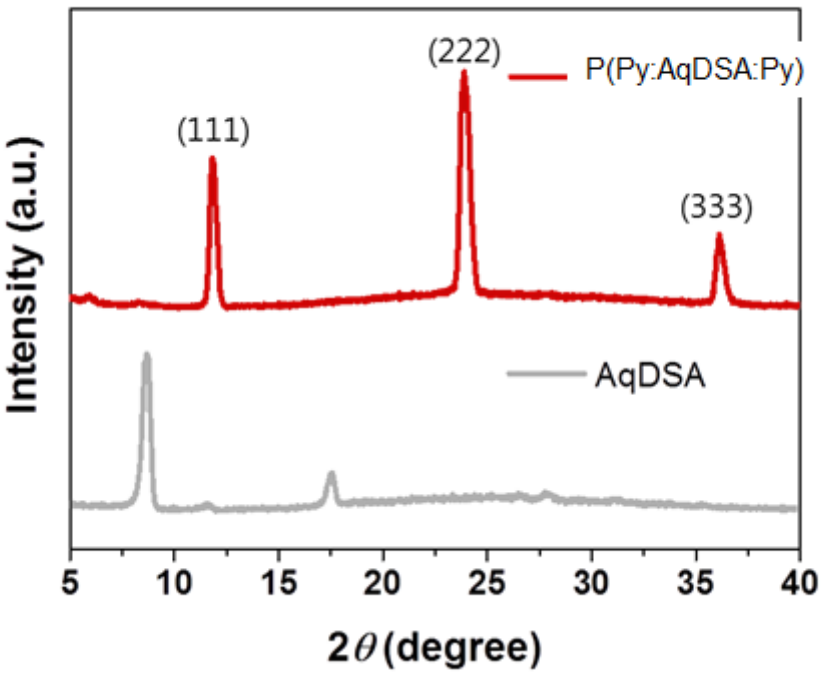


Fig. S7 XRD spectra of AqDSA and P(Py:AqDSA:Py) films. The observed peaks were correlated to the measured *d* spacings in [111] direction by HRTEM measurement, which is correlated with the growth direction of polymer backbones.

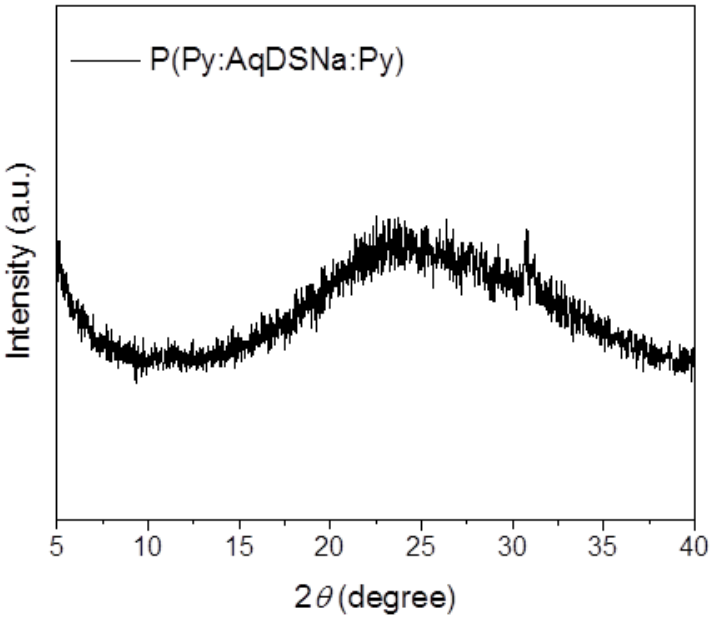


Fig. S8 XRD spectrum of P(Py:AqDSNa:Py) film. The spectrum indicates demonstrated amorphous natures.

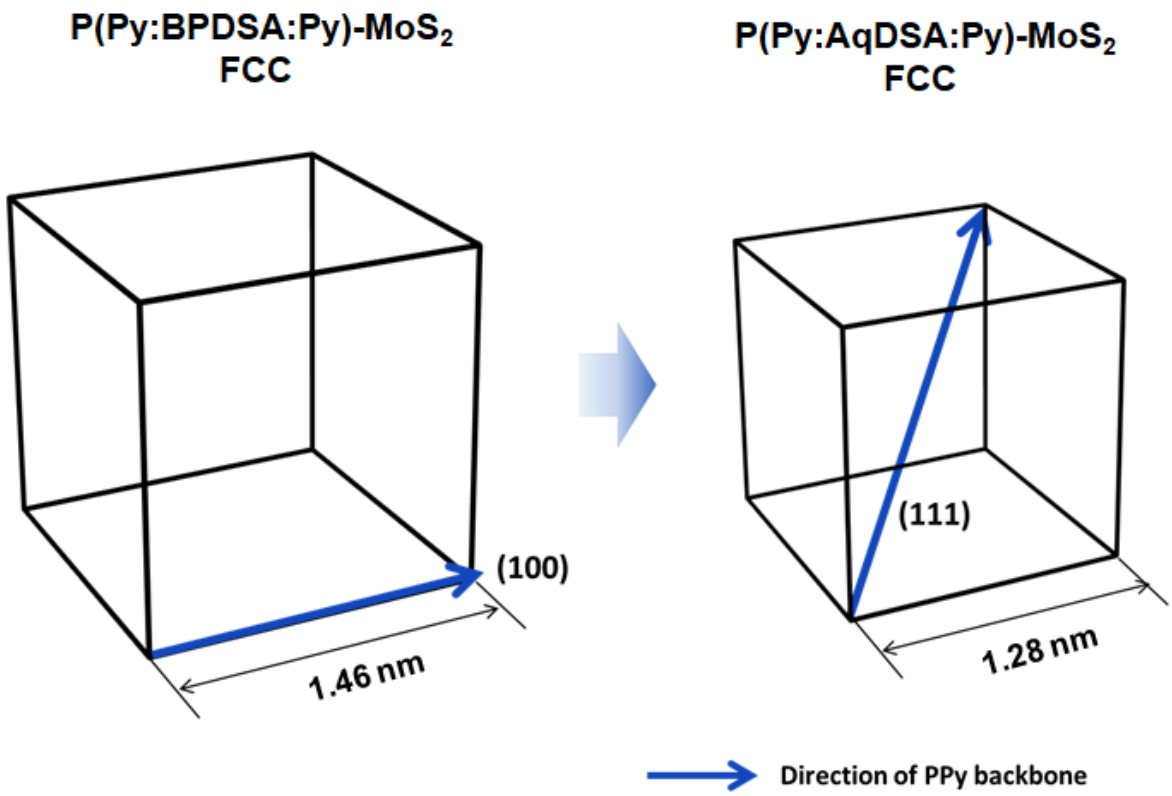


Fig. S9 A unit cell of FCC structure with different lattice parameters.

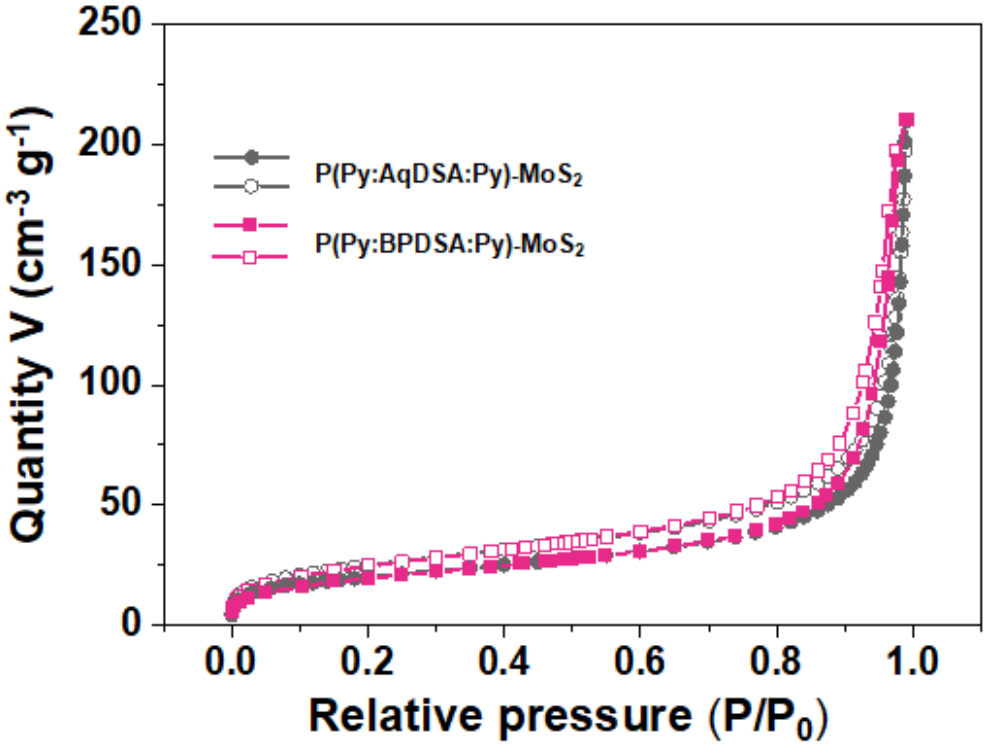


Fig. S10 N_2 adsorption/desorption isotherms of P(Py:AqDSA:Py)-MoS_2 and P(Py:BPDSA:Py)-MoS_2.

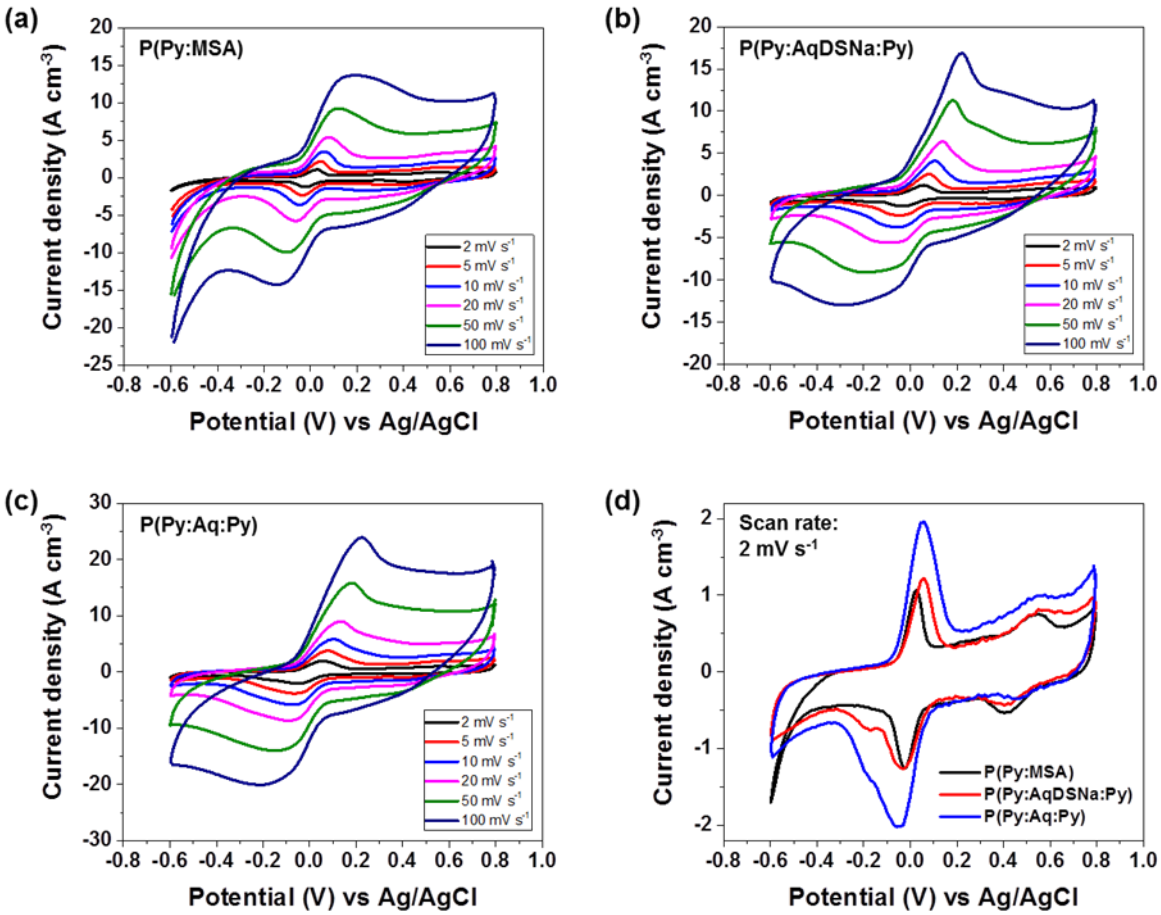


Fig. S11 Electrochemical performance of *in situ* polymerized films. CV curves of (a) P(Py:MSA), (b) P(Py:AqDSNa:Py) and (c) P(Py:AqDSA:Py) at various scan rates. (d) CV curves of the polymer films at scan rate of 2 mV s^{-1}.

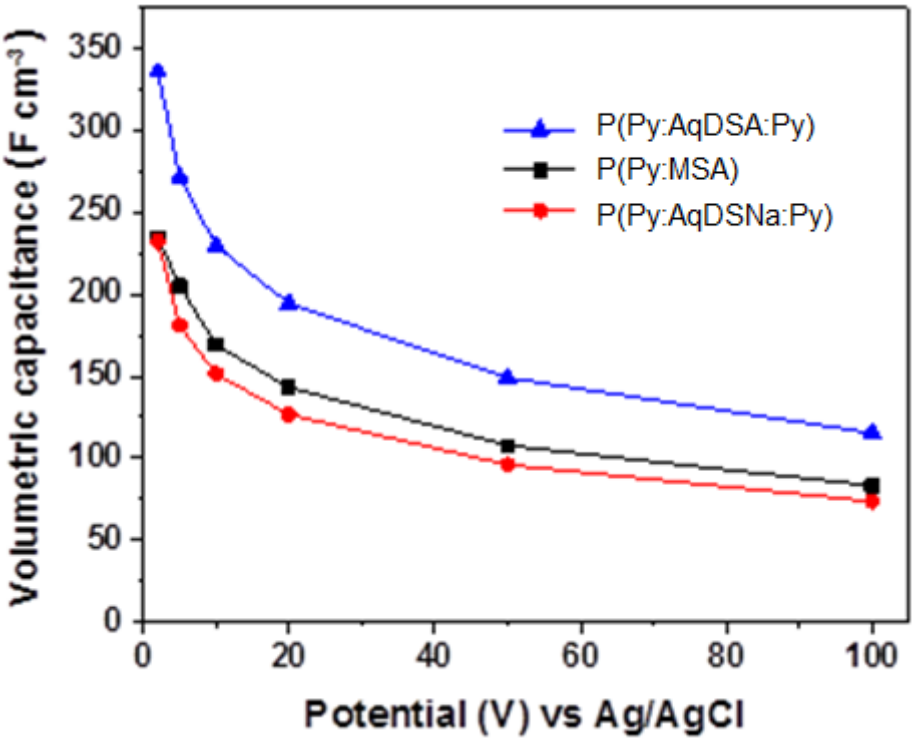


Fig. S12 Volumetric capacitances of P(Py:MSA), P(Py:AqDSNa:Py) and P(Py:AqDSA:Py) at various scan rates.

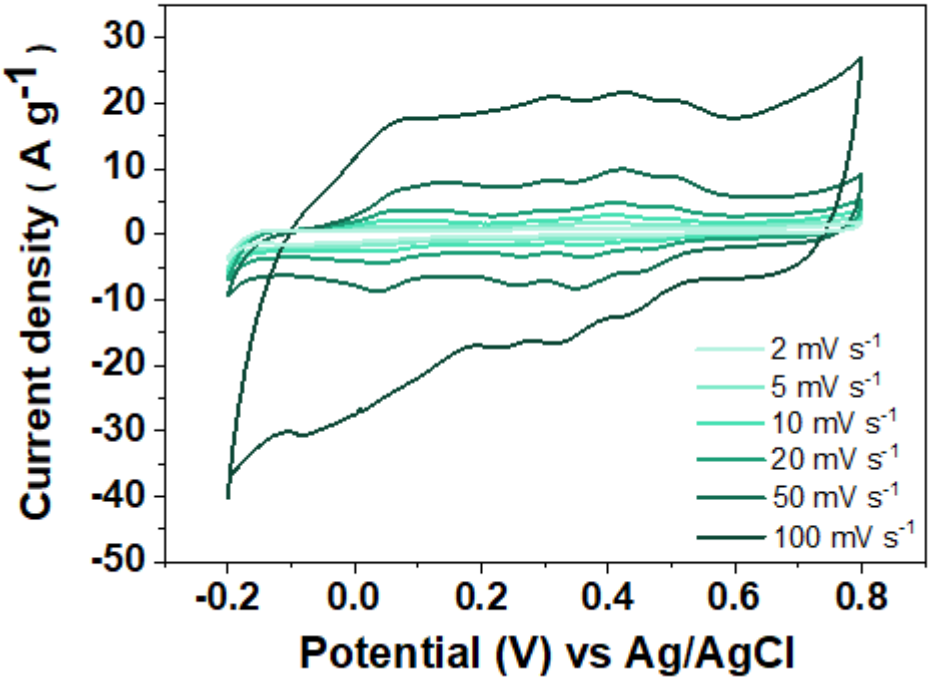


Fig. S13 CV curves of P(Py:MSA)-MoS_2 at various scan rates.

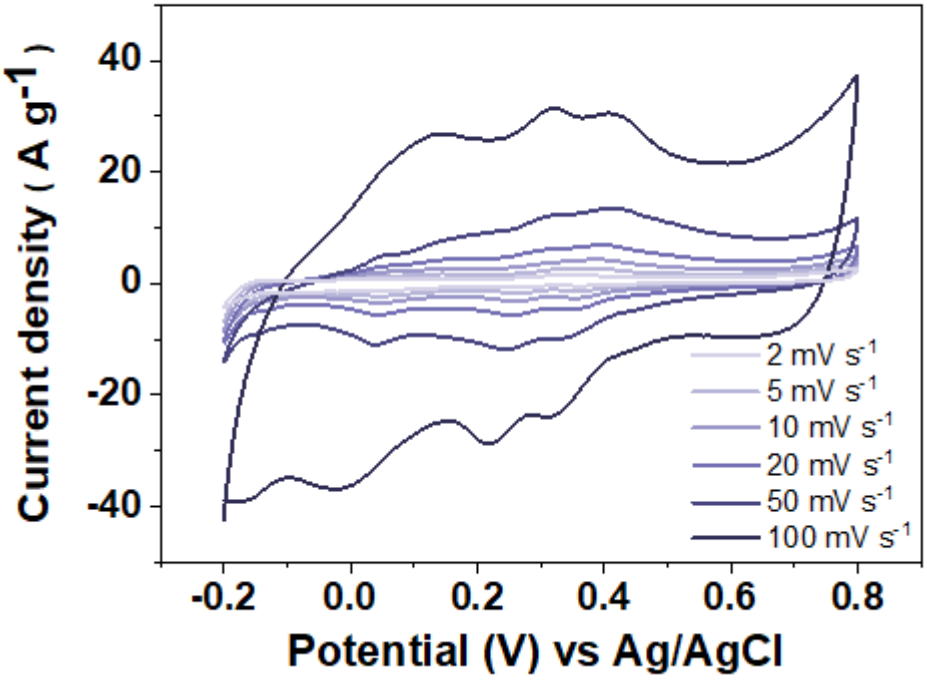


Fig. S14 CV curves of PPy-MoS_2 at various scan rates.