Electronic Supplementary Information

Polyimide based all-organic sodium ion battery

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Materials characterization

N,N′-diamino-3,4,9 10 perylenetetracarboxylic polyimide (PI):

Solid State ^{13}C MAS NMR [100 MHz, δ]: 160.47, 133.41, 129.09, 125.36, 123.73, 121.72 and 119.56. FTIR (KBr, cm^{-1}): 1701, 1662, 1590, 1399 and 1366. Elemental analysis: Calculated value for $(C_{26}H_{12}N_2O_4)_n$: C 73.68 %, H 2.85 % and N 7.14%; found: C 73.85 %, H 2.58 % and N 7.18%.

Disodium terephthalate (NaTP):

^{1}H NMR [500 MHz, $CDCl_3$, δ]: 7.79 (4H, s). FTIR (KBr, cm^{-1}): 1551, 1380, 1314, 824 and 742.

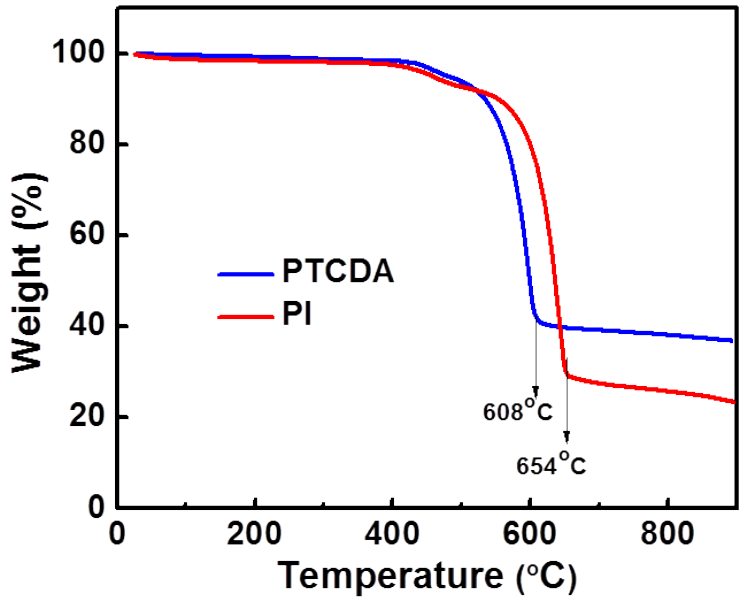

Fig S1: Thermo gravimetric analysis shows a better thermal stability for PI compared to PTCDA. TGA curves for PTCDA and PI obtained under Nitrogen at a heating rate of 10 ^{o}C min^{-1}.

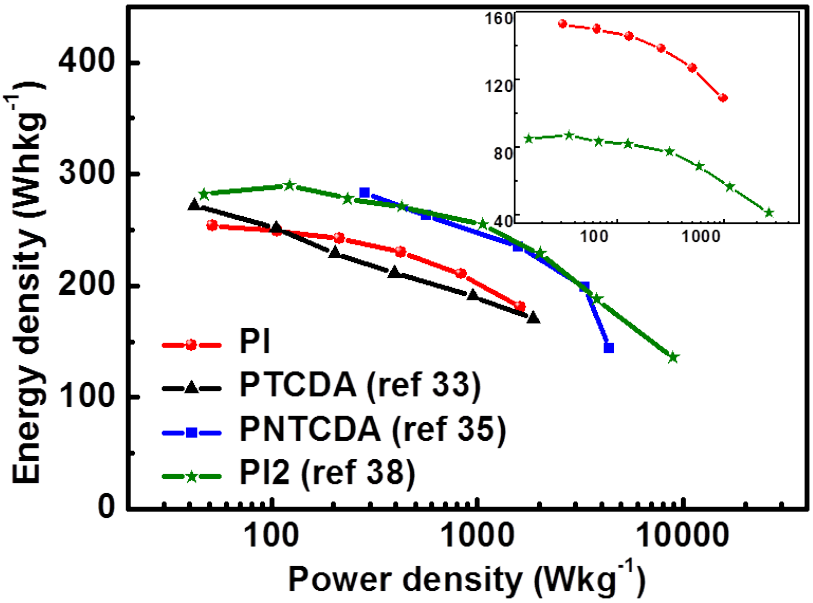

Fig S2: Specific power density *vs.* specific energy density (Ragone plot) showing the high power performance of polyimide based electrodes for SIBs. While the performances of PI2 and PNTCDA are relatively higher, the active material loading is very low (30% of the electrode weight). Such a high composition of conductive carbon is detrimental. Inset: Modified Ragone plot of PI and PI2 (ref 38) electrodes based on the energy and power calculated from the entire electrode composition. PI shows better performance by the virtue of its new morphology and minimum electrochemical dead weight.

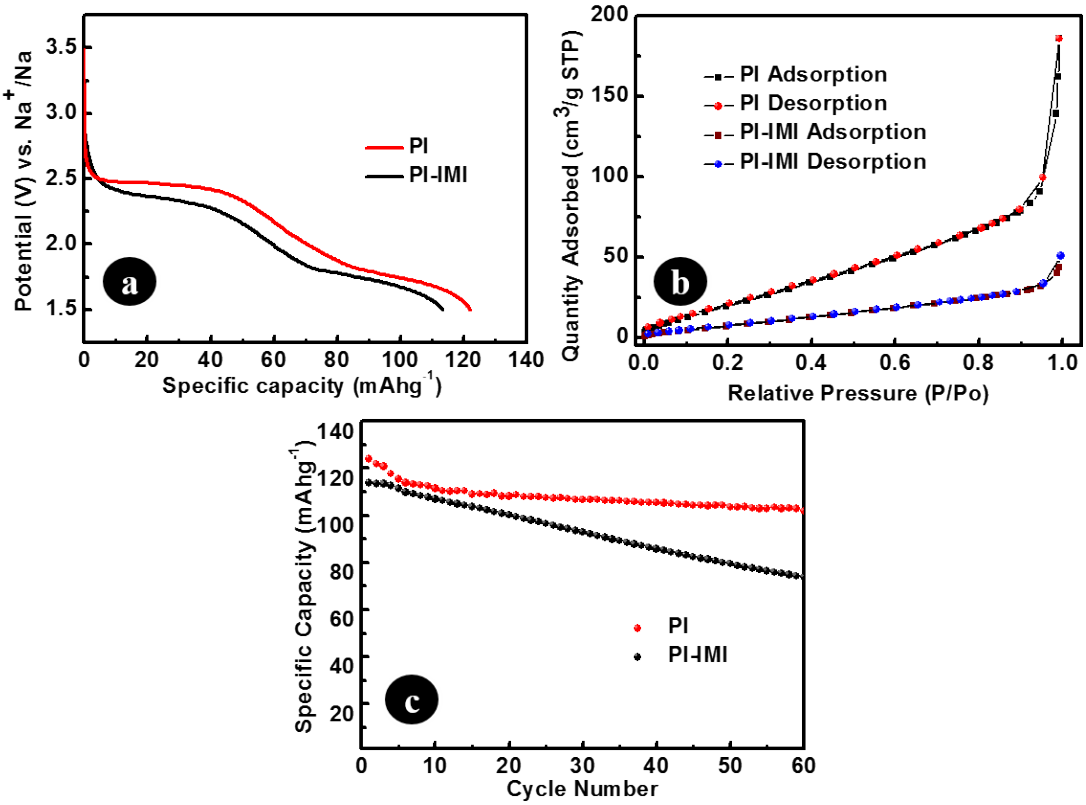

Fig S3: (a) Voltage profiles of PI and PI-IMI when galvanostatically discharged at a current density of 10 mAg^{-1} till 1.5 V *vs.* Na^+/Na. (b) N_2 gas adsorption-desorption isotherms measured at 77 K for PI and PI-IMI up to a maximum relative pressure of 1 (c) Charge discharge cycling performance of PI and PI-IMI galvanostatically cycled between 1.5 and 3.5 V *vs*. Na^+/Na at a current density of 100 mAg^{-1}.

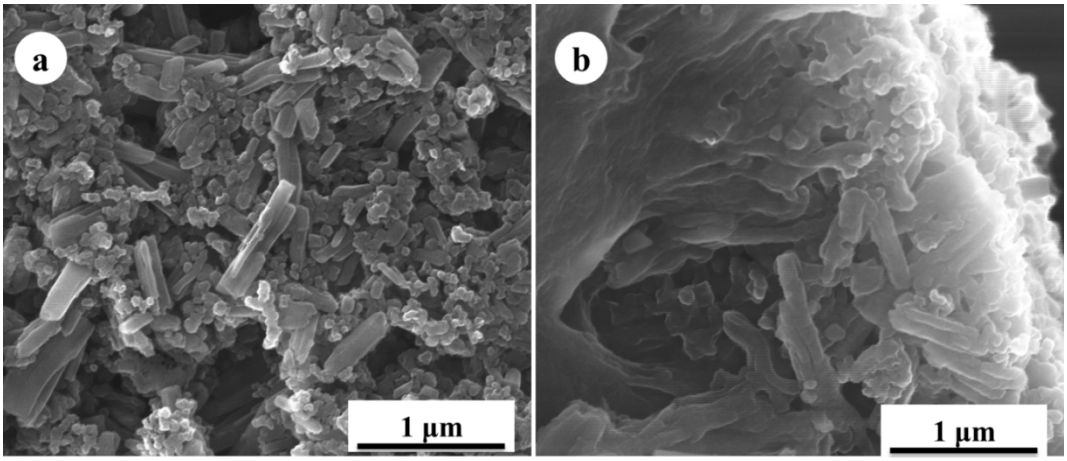

Fig. S4: (a) SEM micrographs of PI electrode before galvanostatic cycling and (b) after 50 cycles of galvanostatic cycling at a current density of 100 mAg^{-1} between 1.5 and 3.5 V *vs.* Na^{+}/Na. SEM measurements were carried out by dis-assembling the fabricated coin cells before and after cycling, for better comparison.

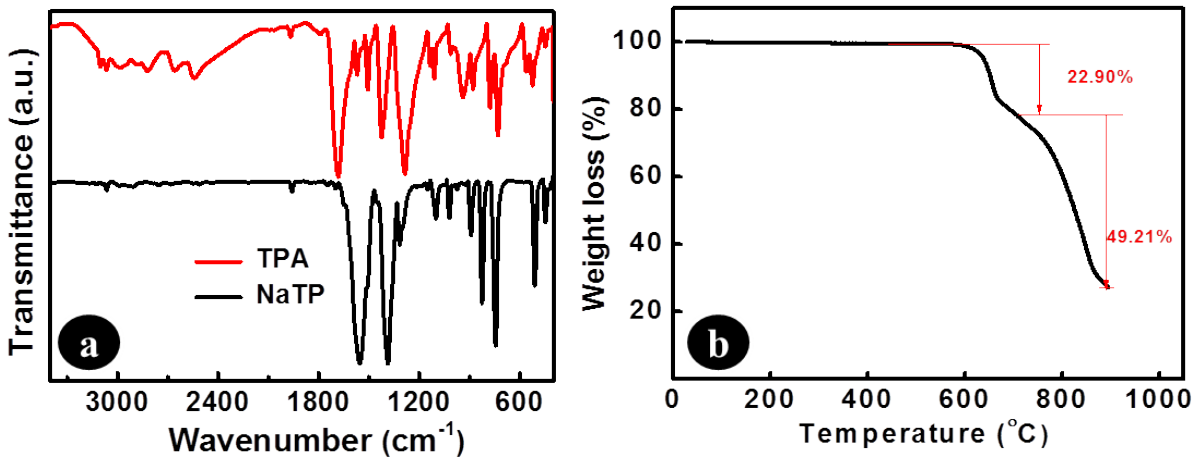

Fig S5: (a) FT-IR spectra (KBr pellets) for terephthalic acid (TPA) and NaTP (b) Thermo gravimetric analysis for NaTP carried out under Nitrogen atmosphere at a heating rate of 10 $^{o}C\ min^{-1}$.

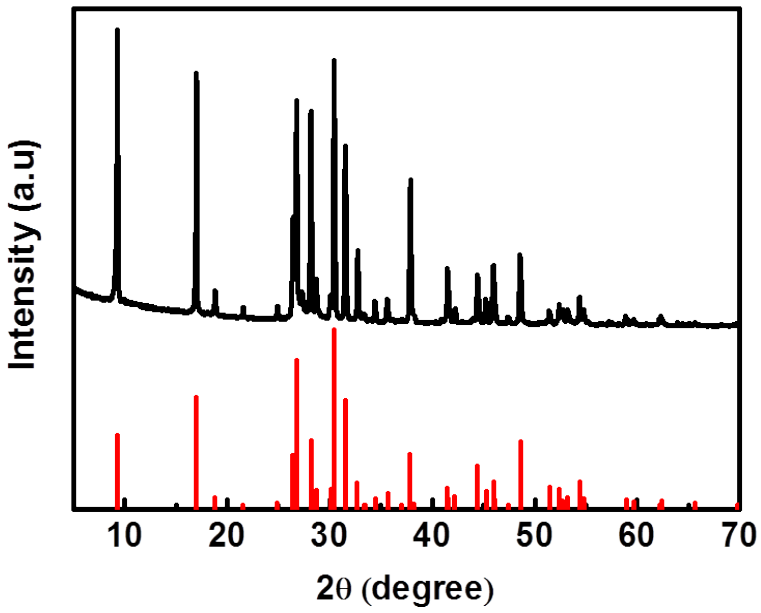

Fig S6: Powder X-ray diffraction pattern for NaTP, matched with the JCPDS Card# 00-052-2146