Supporting Information

In-situ growth of polyimide nanoarrays onto conductive carbon supports for high-rate charge storage and long-lived metal-free cathodes

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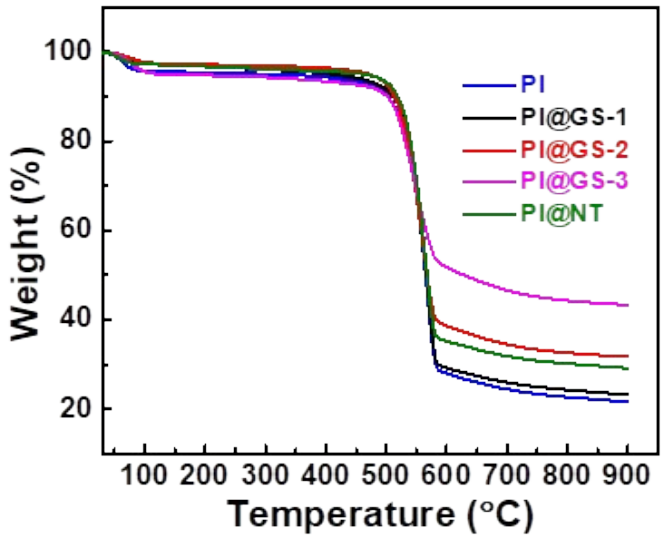


Fig. S1. TGA curves of pure PI, PI@GS, and PI@NT composites.

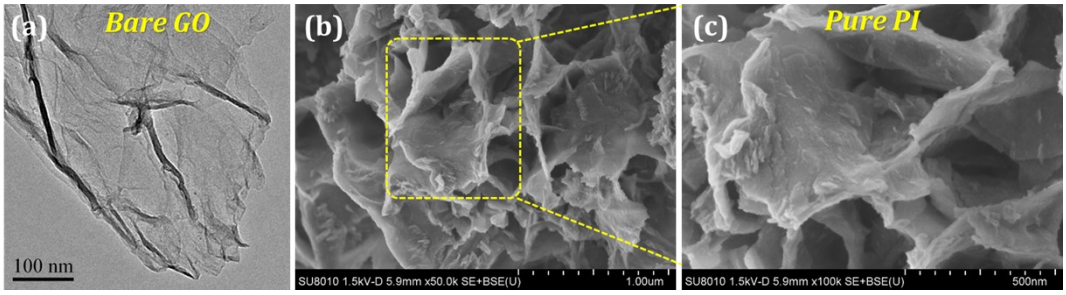


Fig. S2. (a) TEM of bare GO and (b, c) SEM images of pure PI.

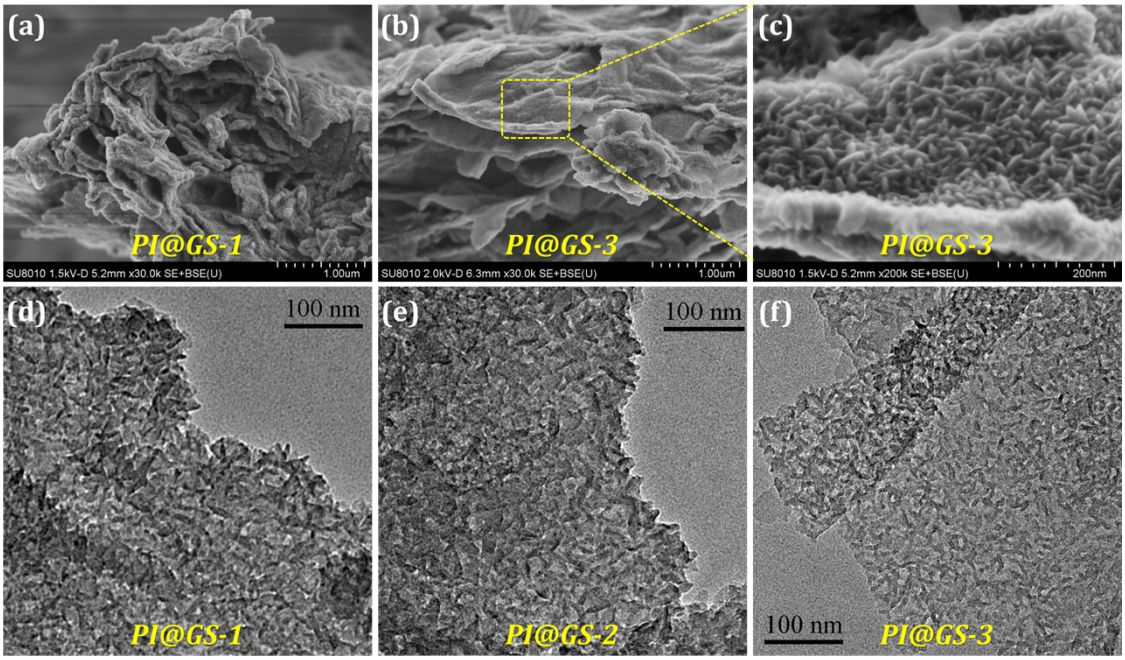


Fig. S3. SEM (a-c) and TEM (d-f) images of PI@GS composites.

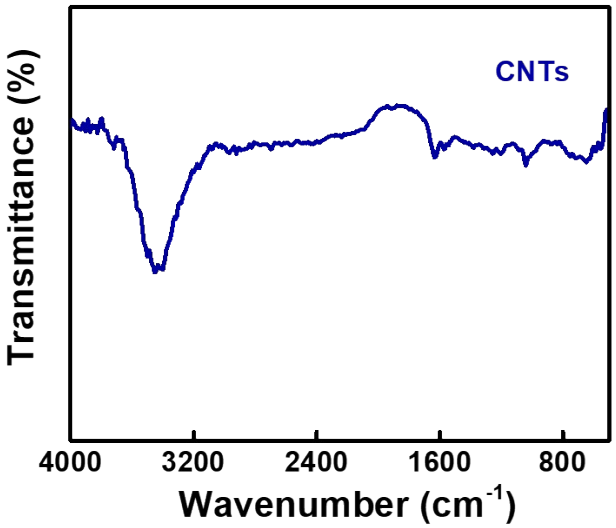


Fig. S4. FT-IR spectrum of acid-treated CNTs.

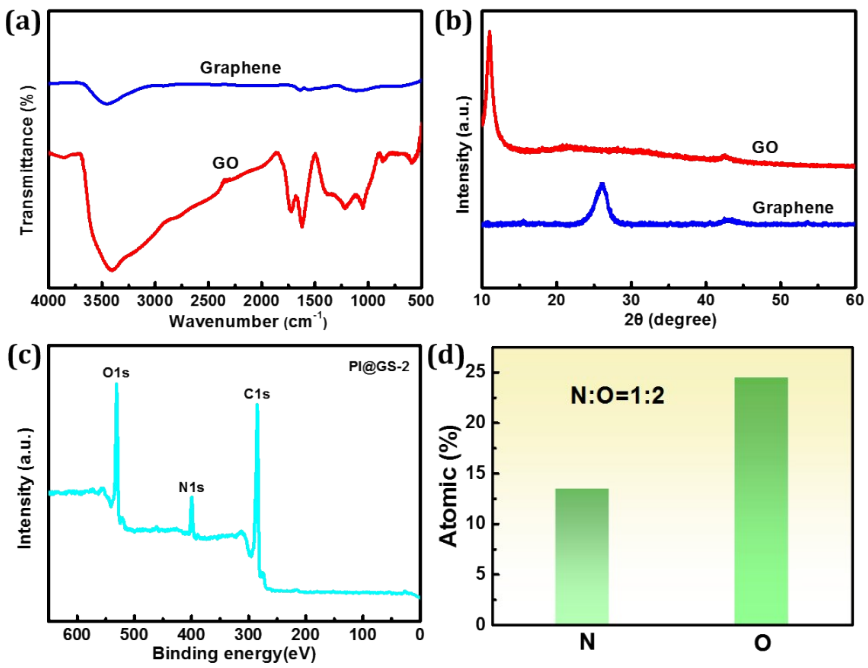


Fig. S5. (a) FT-IR spectra and (b) XRD patterns of GO and graphene, (c) typical XPS survey spectrum and (d) EDS of PI@GS-2.

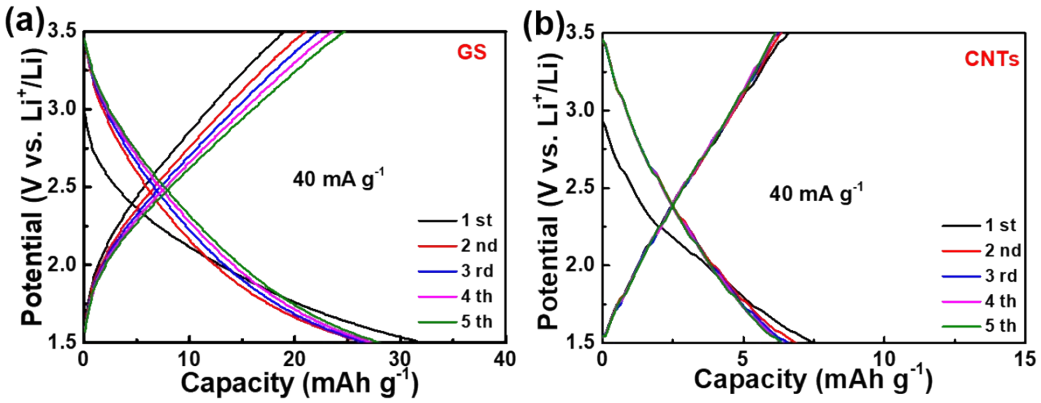


Fig. S6. The capacity contribution of GS and CNTs for LIBs.

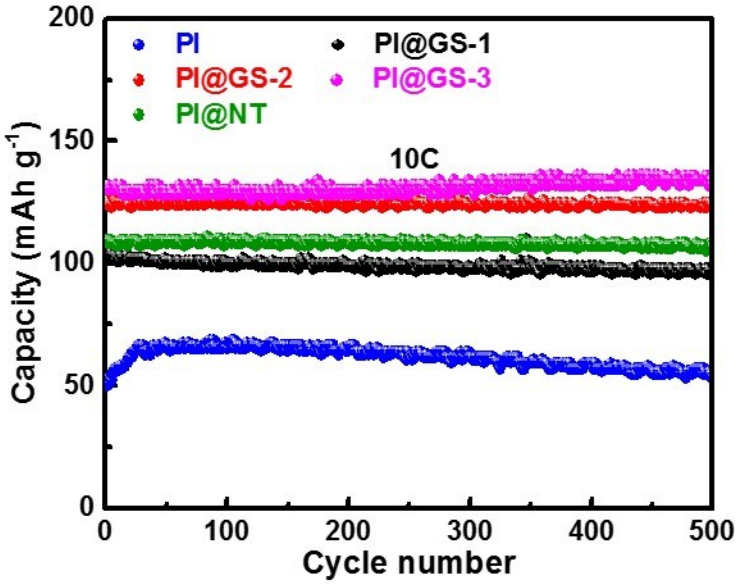


Fig. S7. Cycling performances of coin-type Li/LiTFSI/PI, Li/LiTFSI/PI@GS, and Li/LiTFSI/PI@NT cells at 10C over 500 cycles.

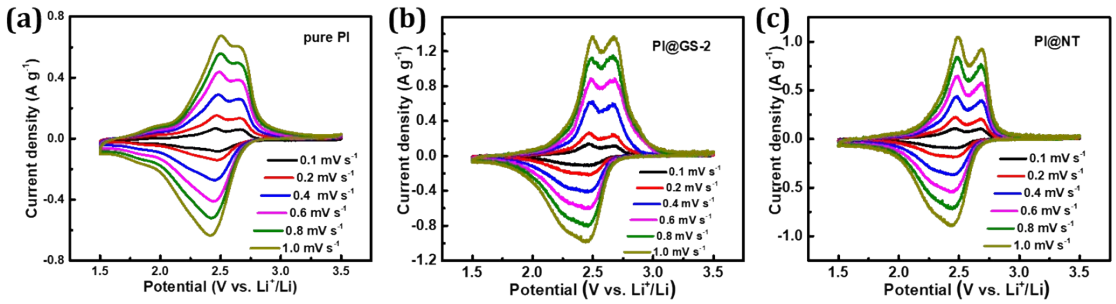


Fig. S8. CV curves of (a) pure PI, (b) PI@GS-2, and (c) PI@NT cathodes at sweep rates of 0.1 to 1.0 mV s^{-1}.

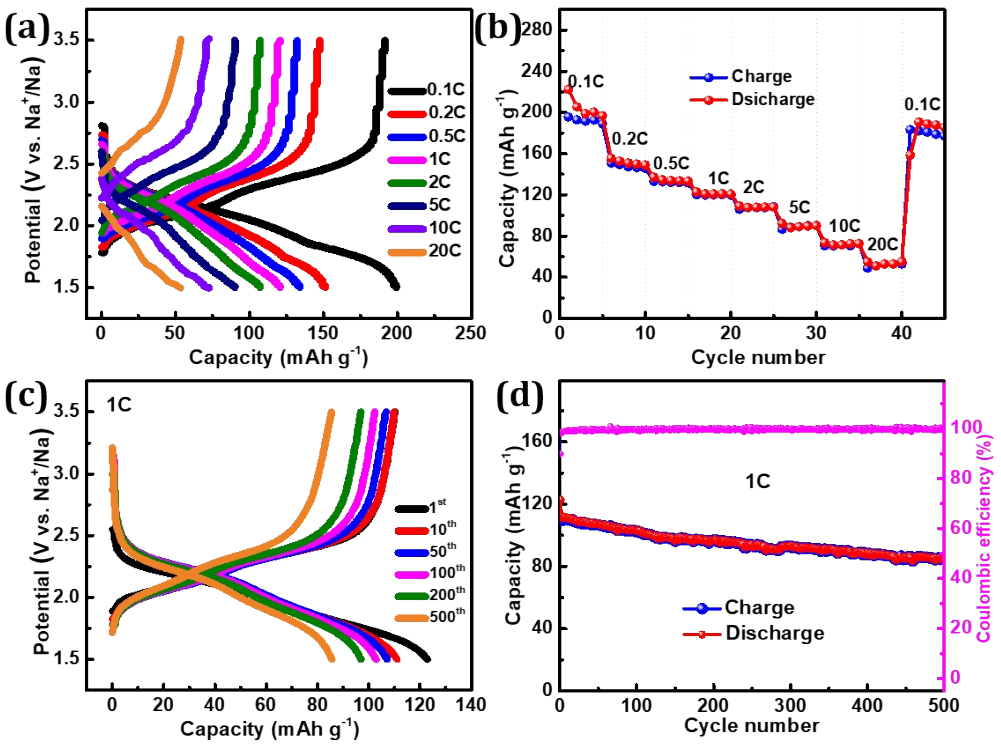
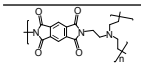
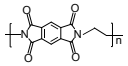
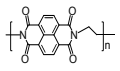
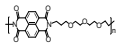
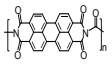
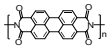
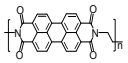
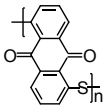
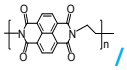


Fig. S9. Na-ion storage performance of Na/$NaPF_6$/PI@GS-2 cells: (a) charge/discharge curves and (b) rate performance measured in the rate range of 0.1C to 20 C, (c) charge/discharge curves at different cycles and (d) cycling stability measured at 1C for 500 cycles.

Table S1. The comparison of reported carbonyl polymers for LIB cathodes.

Materials	Theoretical capacity (mAh g^{-1})	Practical (Initial) capacity (mAh g^{-1}), rate	Ratecapacity (mAh g^{-1}), rate	Capacity (mAh g^{-1}), cycle numbers, rate	Ref.
	343 (4e)	160 38.3 mA g^{-1}	74 3.83 A g^{-1}	147 200 191.5 mA g^{-1}	1
	443 (4e)	175 0.1C	101 2C	101 150 0.5C	2
	367 (4e)	127.3 20 mA g^{-1}	108 500 mA g^{-1}	121 60 50 mA g^{-1}	3
	245 (4e)	125 25 mA g^{-1}	86 250 mA g^{-1}	77.6 100 250 mA g^{-1}	4
	322 (5e)	80 50 mA g^{-1}	95 200 mA g^{-1}	130 50 50 mA g^{-1}	5
	276 (4e)	130 50 mA g^{-1}	98 200 mA g^{-1}	110 50 50 mA g^{-1}	5
	257 (4e)	85 50 mA g^{-1}	0 200 mA g^{-1}	75 50 50 mA g^{-1}	5
	225 (2e)	156 0.1C	102 20C	132 1000 0.5C	6
 / Graphene	**367** **(4e)**	**165** **0.1C**	**125** **20C**	**112 (88%)** **5000** **5C**	**This work**

References

1. H. Wu, Q. Meng, Q. Yang, M. Zhang, K. Lu and Z. Wei, *Adv. Mater.*, 2015, **27**, 6504-6510.
2. Y. Meng, H. Wu, Y. Zhang and Z. Wei, *J. Mater. Chem. A*, 2014, **2**, 10842-10846.
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