Carbon nanofibre framework based on π-extended oligo(perylene) diimide for high-rate lithium-ion batteries

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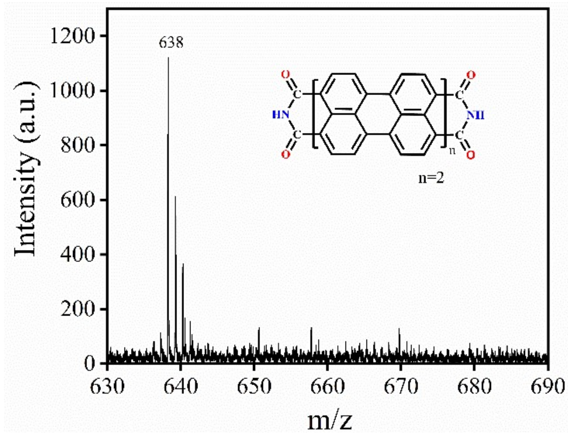

Figure S1. DMF extraction of synthesized products (PTN), TOF-MS of extracted.

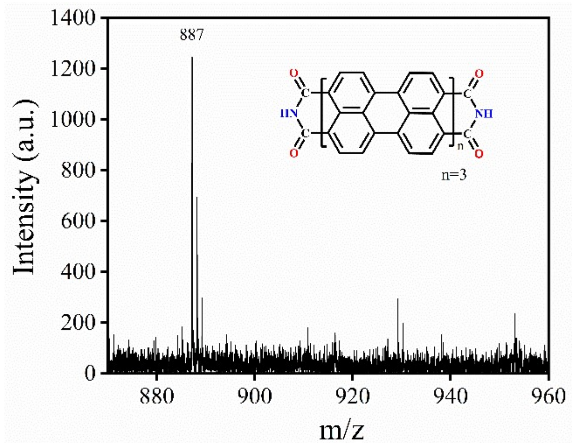

Figure S2. TOF-MS after treatment with a NaOH solution.

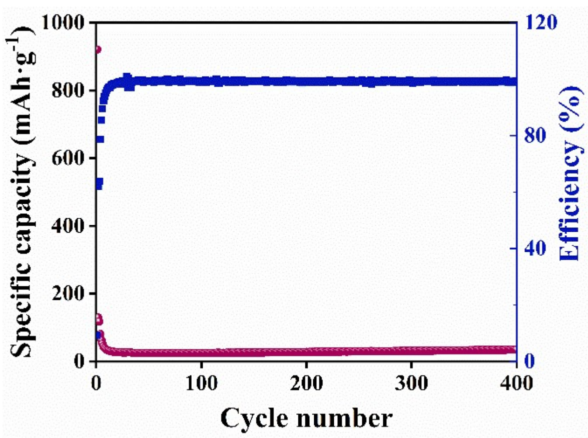

Figure S3. Cycling performance of PTN as a direct anode material for lithium-ion batteries at a current density of 100 $mA \cdot g^{-1}$ (the voltage test range is 0.01-3 V).

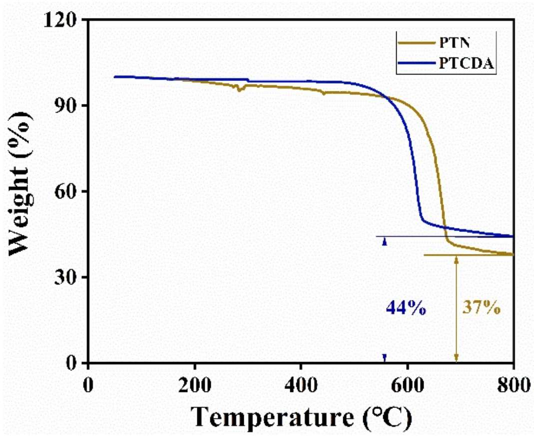

Figure S4. TGA thermogram of PTN and PTCDA with a heating rate of 10 K min^{-1} under Nitrogen atmosphere.

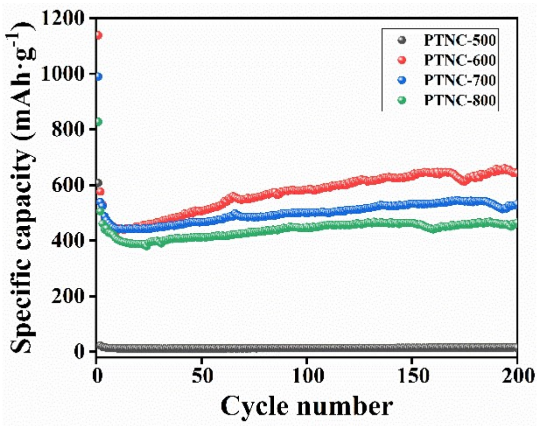

Figure S5. Cycling diagram of PTN at 100 mA·g^{-1} during different carbonization stages temperatures(voltage test range is 0.01-3 V).

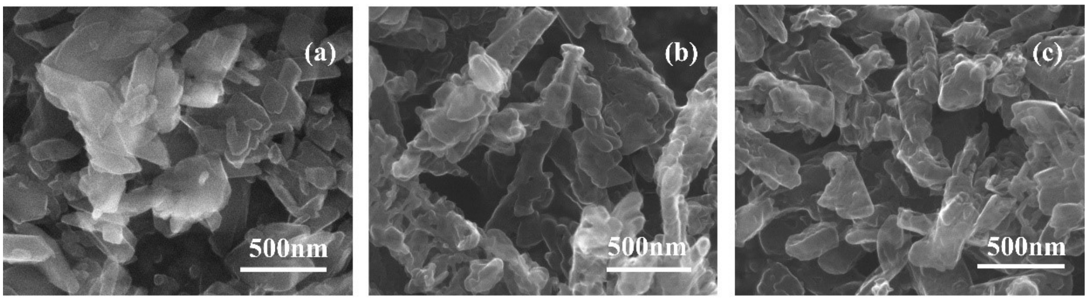

Figure S6. (a), (b), (c) SEM images of PTNC-500, PTNC-700 and PTNC-800

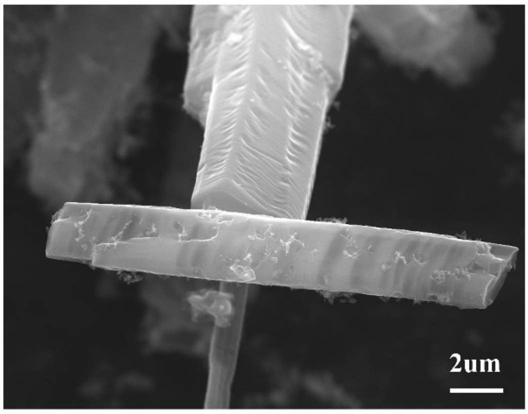

Figure S7. SEM images of PTCDC (PTCDA Material after carbonization at 600°C)

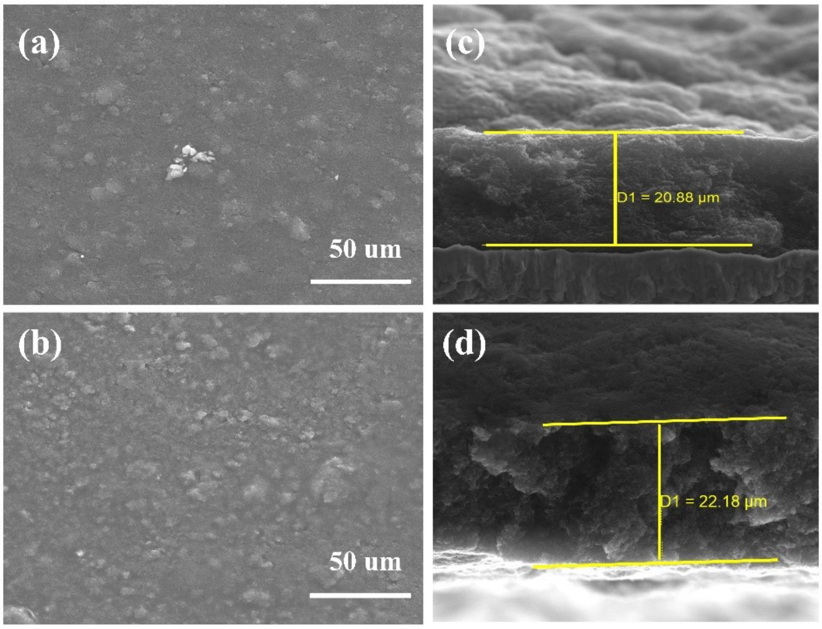

Figure S8. Scanning electron microscopy images of the PTNC-600 electrode before and after 50 cycles: (a, b) surface, and (c, d) cross-section.

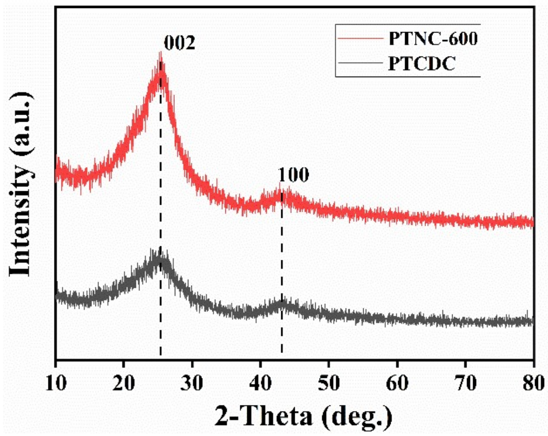

Figure S9. XRD pattern of PTNC-600 and PTCDC.

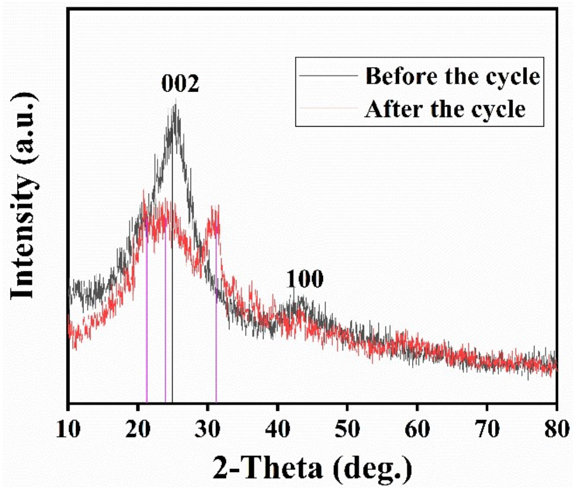

Figure S10. XRD images of PTNC-600 electrodes before and after 50 cycles.

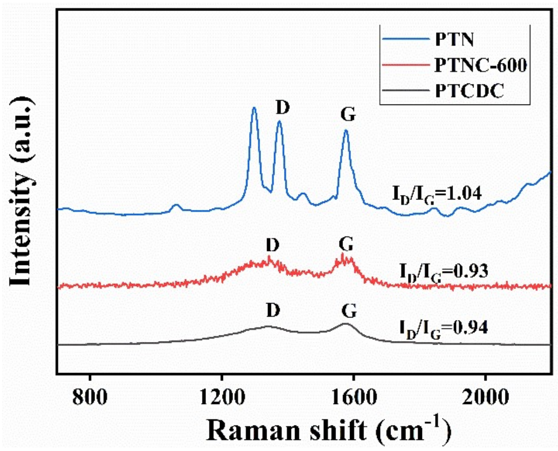

Figure S11. Raman spectrum of PTN, PTNC-600, and PTCDC.

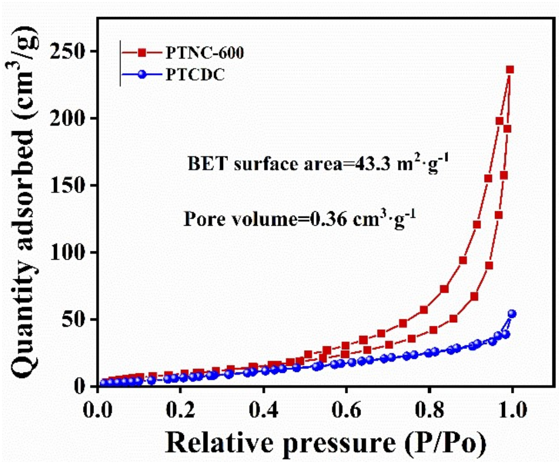

Figure S12. N_2 adsorption-desorption curves of PTNC-600 and PTCDC.

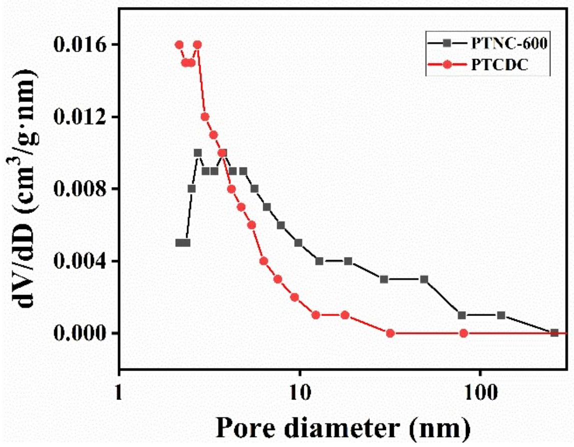

Figure S13. Pore size distribution of the adsorption branches of PTNC-600 and PTCDC materials obtained using the BJH method.

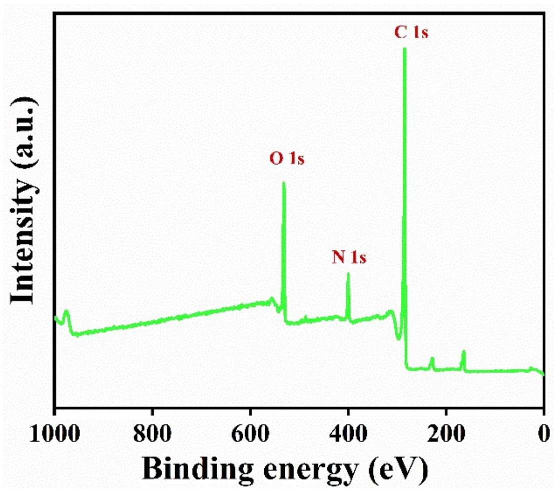

Figure S14. XPS survey spectrum of PTN. Characteristic peaks corresponding to C 1s, N 1s, and O 1s were observed at 283.9, 398.5, and 533.9 eV, respectively.

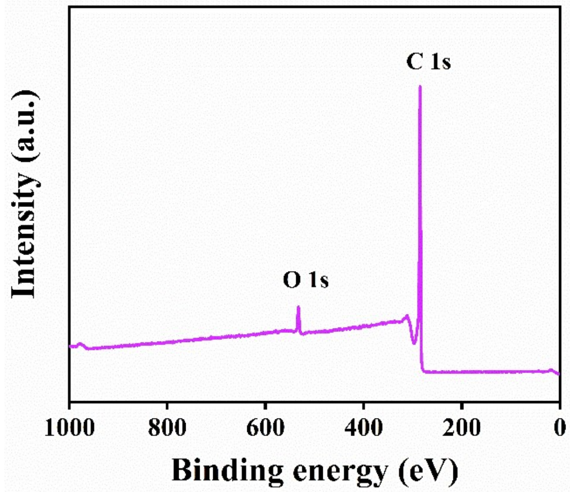

Figure S15. XPS survey spectrum of PTCDC. Characteristic peaks corresponding to C 1s and O 1s were observed at 283.9 eV and 533.9 eV, respectively.

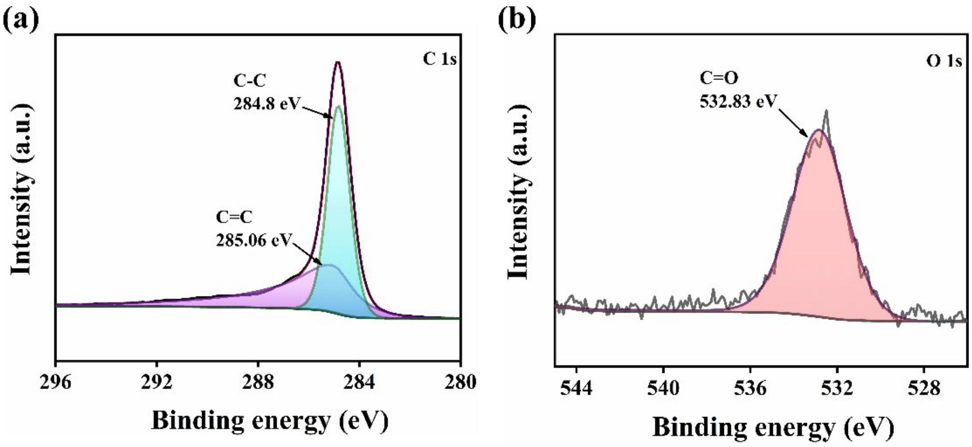

Figure S16. High-resolution XPS spectra of C 1s and O 1s for PTCDC (a-b).

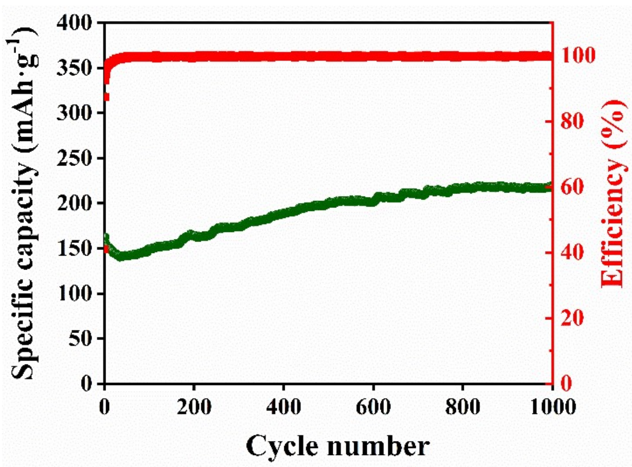

Figure S17. Cycling plot of PTCDC after 1000 cycles at a current density of 1000 $mA\cdot g^{-1}$ (voltage test range is 0.01-3 V).

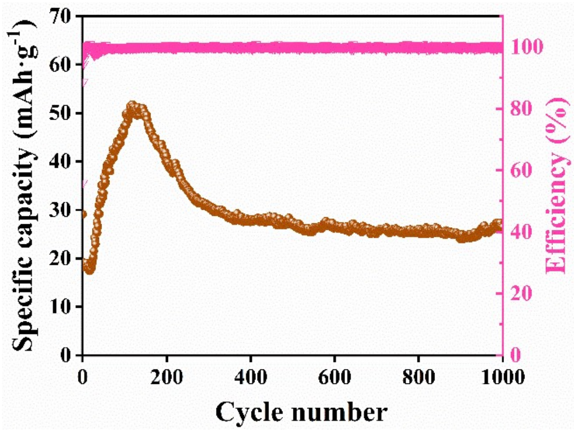

Figure S18. Cycling plot of PTCDC after 1000 cycles at a current density of 2000 mA·g^{-1} (the voltage test range is 0.01-3 V).

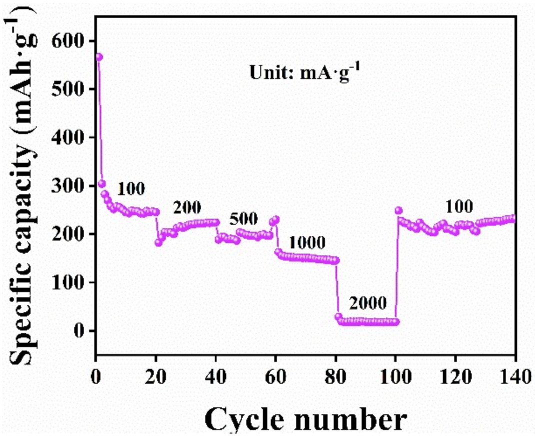

Figure S19. Rate performance plot of PTCDC at current densities ranging from 100 mA·g^{-1} to 200 mA·g^{-1}, 500 mA·g^{-1}, 1000 mA·g^{-1}, 2000 mA·g^{-1}, and back to 100 mA·g^{-1} (voltage test range is 0.01-3 V).

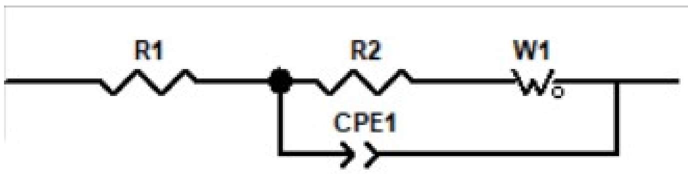

Figure S20. Impedance fitting equation graph. In the diagram, R2 represents the charge transfer resistance, and R1 represents the diffusion impedance.

Table S1. Impedance fitting

	Before cycle (Ω)		After 300 cycles (Ω)
R1	1.142	R1	8.67
R2	292.5	R2	70.7

Table S2. Comparison of electrochemical

Material after precursor carbonization	Capacity ($mAh \cdot g^{-1}$) after cycling	Capacity ($mAh \cdot g^{-1}$) after cycling	References
PHC-1	586.1 at 1 C after 500 cycles	251.7 at 5 C after 1800 cycles	1
PTCDA-1100	245.8 at 1 C after 100 cycles	156.4 at 5 C after 100 cycles	2
PTPAO@600	1142.5 at 0.1 $A \cdot g^{-1}$ after 800 cycles	490.9 at 1 $A \cdot g^{-1}$ after 1000 cycles	3
CPP-1-C	517 at 0.2 $A \cdot g^{-1}$ after 200 cycles	436 at 0.5 $A \cdot g^{-1}$ after 500 cycles	4
PTNC-600	670 at 0.1 $A \cdot g^{-1}$ after 270 cycles	380 at 1 $A \cdot g^{-1}$ after 1000 cycles	this work

References

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2. Y. Lou, X. Rao, J. Zhao, J. Chen, B. Li, L. Kuang, Q. Wang, S. Zhong, H. Wang and L. Wu, *New J. Chem.*, 2021, **45**, 16658-16669.
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