Supplementary Materials

Hard Carbons Derived from Phenyl Hyper-Crosslinked Polymers for Lithium-Ion Batteries

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Exfoliation of CHCPB

The exfoliation of CHCPB was performed by ultrasonication. Briefly, 10 mg of the bulk CHCPB samples was added into 20 mL of dimethyl formamide (DMF). The mixture was ultrasonically dispersed for 30 min and kept undisturbed overnight. The supernatant of the dispersion was ultrasonicated at a power of 800 W for 40 min on cell disruption system. The exfoliated CHCPB nanosheets were well-dispersed in DMF and formed a colloidal solution, which could be proved by Tyndall effect (inset of Figure 2f).

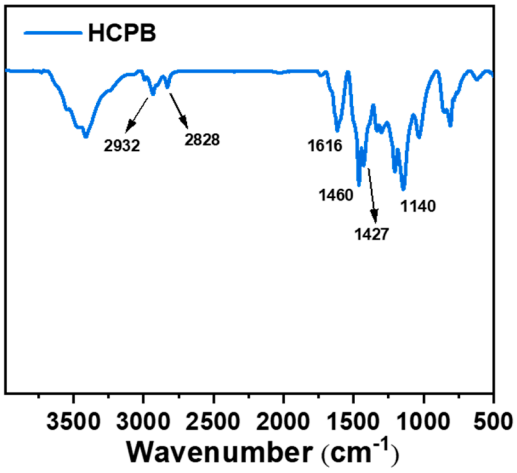

Figure S1. FTIR spectrum of HCPB.

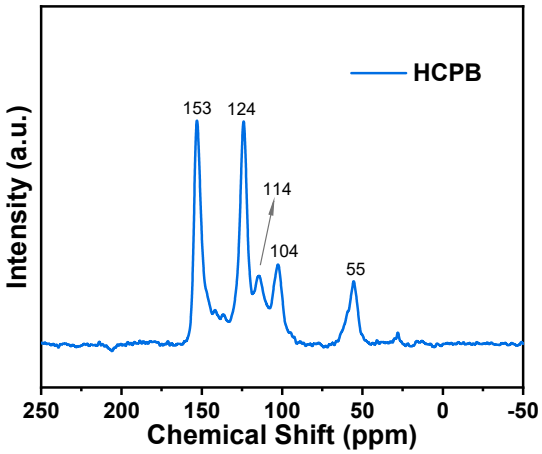

Figure S2. ^{13}C CP/MAS NMR spectrum of HCPB.

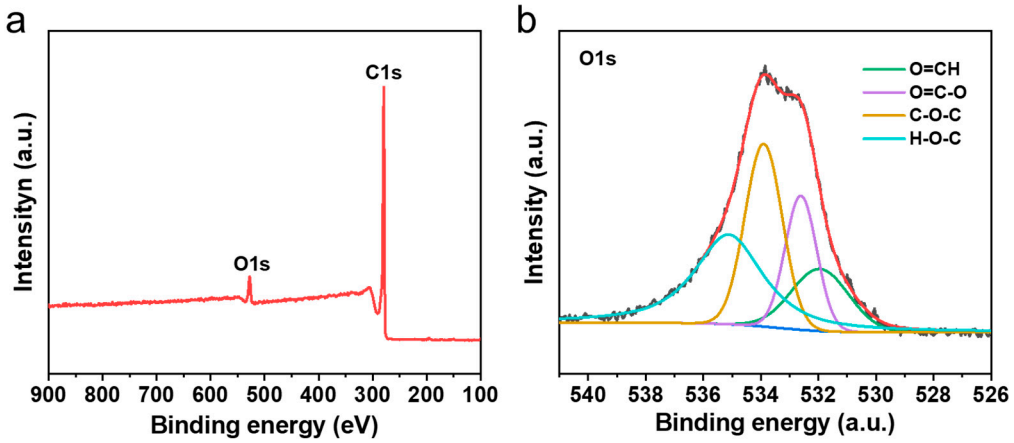

Figure S3. (**a**) XPS spectrum and (**b**) high resolution spectrum of O1s for CHCPB.

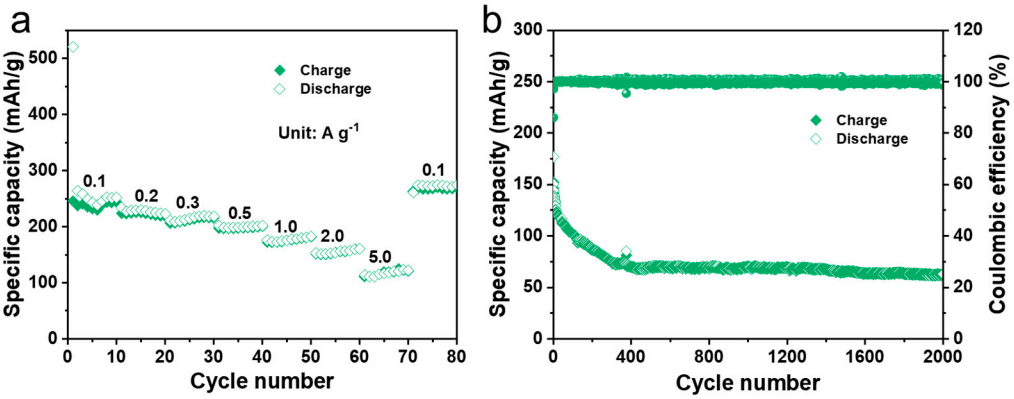

Figure S4. (**a**) the rate property and (**b**) long-term running property at 2 A g^{-1} of commercial hard carbon (CHC).

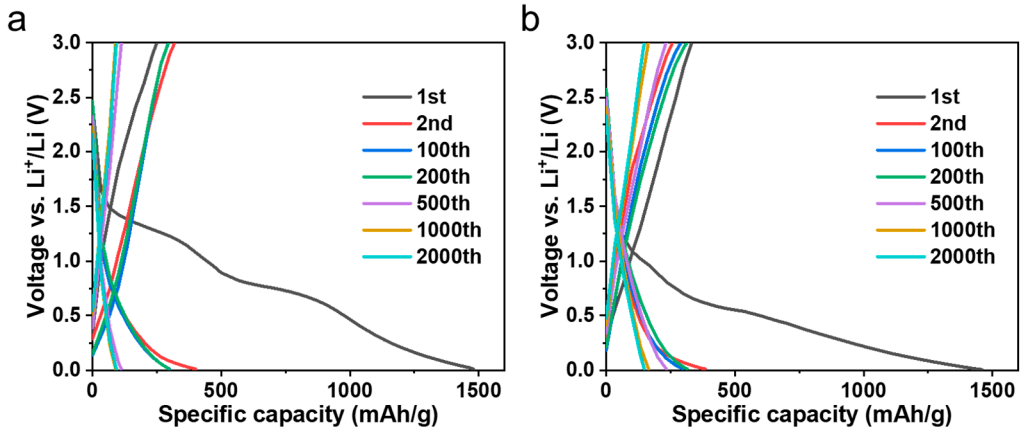

Figure S5. Galvanostatic charge-discharge curves of (**a**) HCPB and (**b**) CHCPB at 2 A g^{-1}.

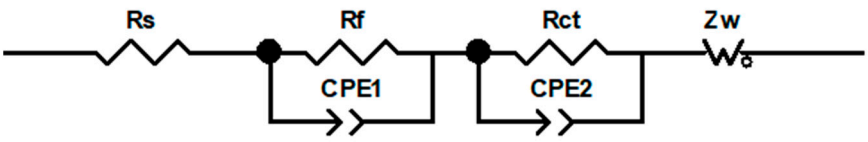

Figure S6. The EIS fitting circuit model of HCPB and CHCPB electrodes.

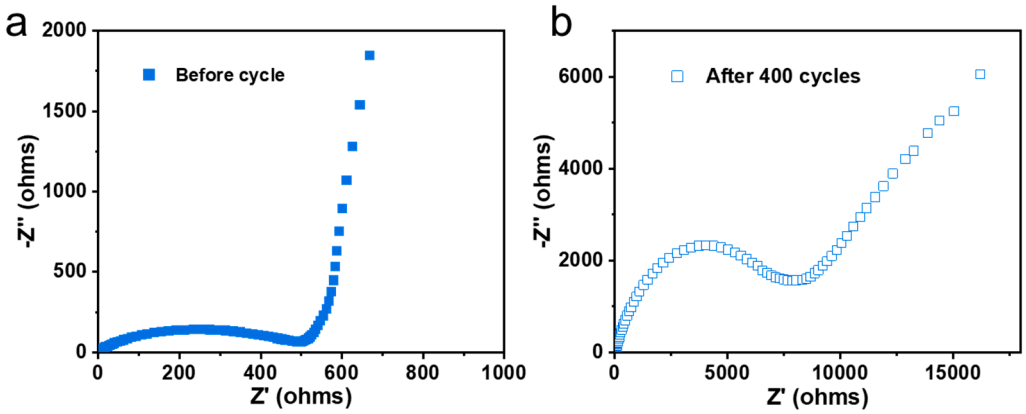

Figure S7. EIS of the HCPB electrode before (**a**) and after cycling (**b**).

Table S1. The elemental composition determined by EA.

Sample	Elemental Analysis (wt%)		
	C	H	O
HCPB	65.67	2.99	31.34
CHCPB	87.95	0.90	11.15

Table S2. Comparison of the electrochemical performances with some reported polymers-derived carbon materials.

Sample Name	Capacity (mAh g^{-1})	Rate Capacity (mAh g^{-1})	Ref.
CHCPB	699 (0.1 A g^{-1})	261 (2 A g^{-1}), 165 (5 A g^{-1})	This work
NPCN	416 (0.1C), 1C = 550 mA g^{-1}	166 (5 C)	[1]
HSHPC	660 (0.1A g^{-1})	159 (5 A g^{-1})	[2]
CHCPB-K-600	833 (0.1 A g^{-1})	224 (2 A g^{-1})	[3]
PTPAO@600	480 (0.1 A g^{-1})	275 (2 A g^{-1})	[4]
FTPC	786 (0.1 A g^{-1})	158 (2 A g^{-1})	[5]
N2HC-K	522 (0.1 A g^{-1})	182 (2 A g^{-1})	[6]

References

1. Zhang, Q.; Dai, Q.; Yan, C.; Su, C.; Li, A. Nitrogen-doped porous carbon nanoparticle derived from nitrogen containing conjugated microporous polymer as high performance lithium battery anode. *Journal of Alloys and Compounds* **2017**, *714*, 204-212, doi:10.1016/j.jallcom.2017.04.207.
2. Yang, X.; Wei, C.; Sun, C.; Li, X.; Chen, Y. High performance anode of lithium-ion batteries derived from an advanced carbonaceous porous network. *Journal of Alloys and Compounds* **2017**, *693*, 777-781, doi:10.1016/j.jallcom.2016.09.192.
3. Zhang, C.; Kong, R.; Wang, X.; Xu, Y.; Wang, F.; Ren, W.; Wang, Y.; Su, F.; Jiang, J.-X. Porous carbons derived from hypercrosslinked porous polymers for gas adsorption and energy storage. *Carbon* **2017**, *114*, 608-618, doi:10.1016/j.carbon.2016.12.064.
4. Li, C.; Kong, D.; Wang, B.; Du, H.; Zhao, J.; Dong, Y.; Xie, Y. Conjugated microporous polymer derived N, O and S co-doped sheet-like carbon materials as anode materials for high-performance lithium-ion batteries. *Journal of the Taiwan Institute of Chemical Engineers* **2022**, *134*, doi:10.1016/j.jtice.2022.104293.
5. Zhang, Q.; Xu, Z.; Bai, Y.; Zhang, Y. Low temperature synthesis and superior lithium storage properties of fluorine-rich tubular porous carbon. *Journal of Alloys and Compounds* **2022**, *901*, 163657, doi: https://doi.org/10.1016/j.jallcom.2022.163657.
6. Zhang, Q.; Zhang, Y.; Lian, F.; Xu, Z.; Wang, X. Synthesis and lithium storage properties of nitrogen-containing hard carbon from conjugated microporous polymers. *Ionics* **2022**, *28*, 2623-2633, doi:10.1007/s11581-022-04556-w.