Electronic Supplementary Material (ESI) for Physical Chemistry Chemical Physics.

Balancing interlayer spacing, pore structures and conductivity endows hard carbon with high capacity for rechargeable aluminum batteries

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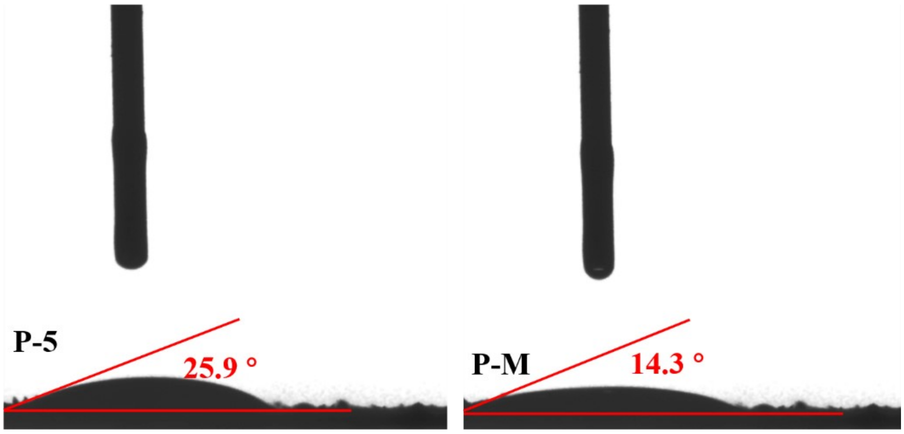

Figure S1. Contact angle test of P-5 and P-M.

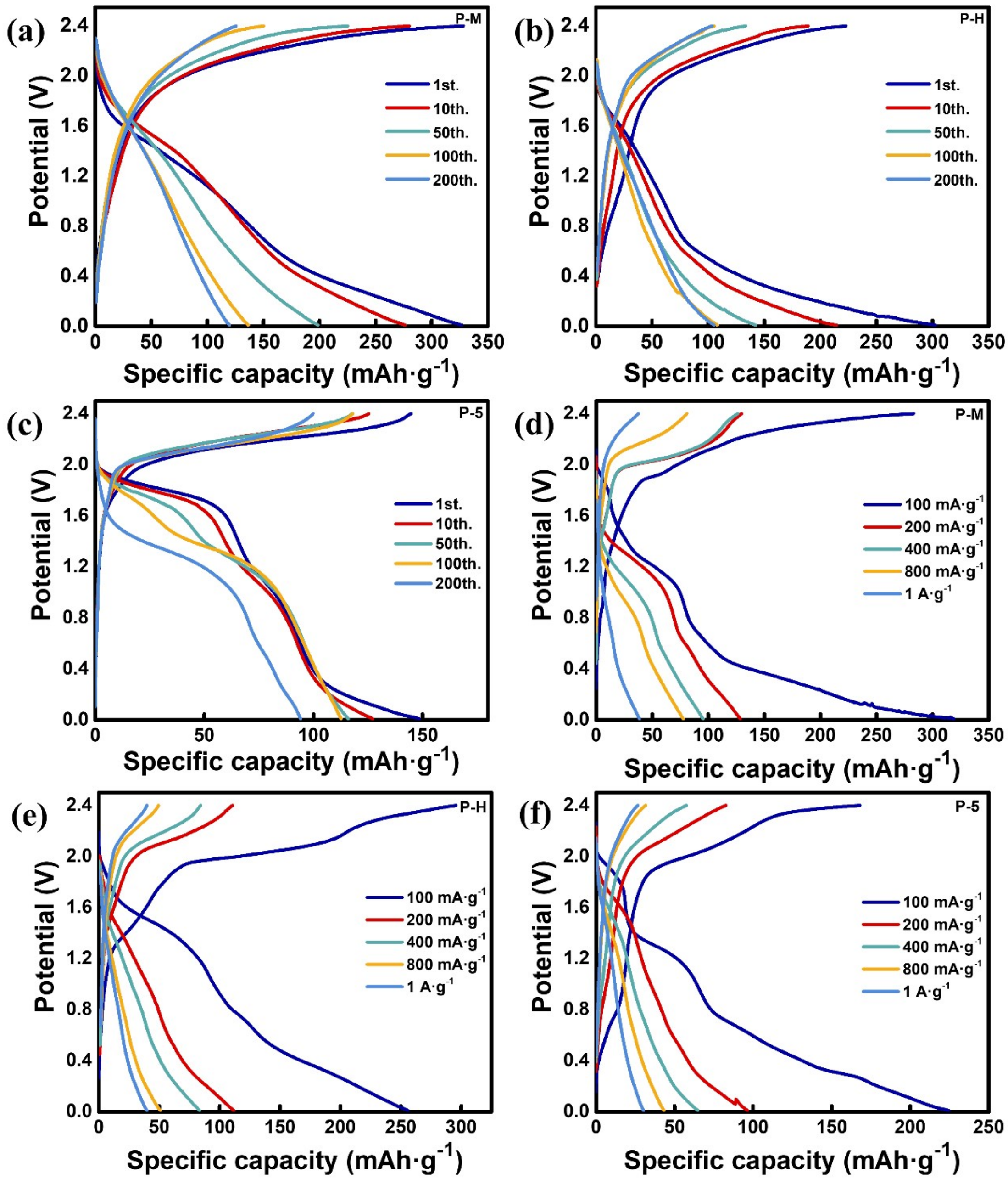

Figure S2. Galvanostatic charge/discharge curves of (a) P-M, (b) P-H, and (c) P-5 at 500 mA·g^{-1} after various cycles. Galvanostatic charge/discharge curves of (d) P-M, (e) P-H, and (f) P-5 at different current densities.

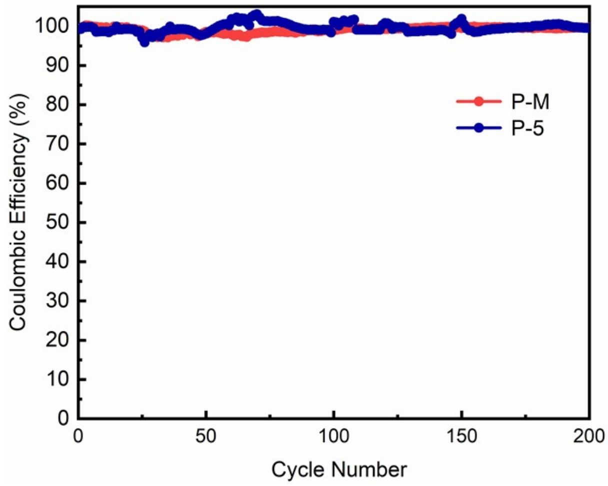

Figure S3. Coulombic Efficiency of P-5 and P-M at 500 mA·g^{-1}.

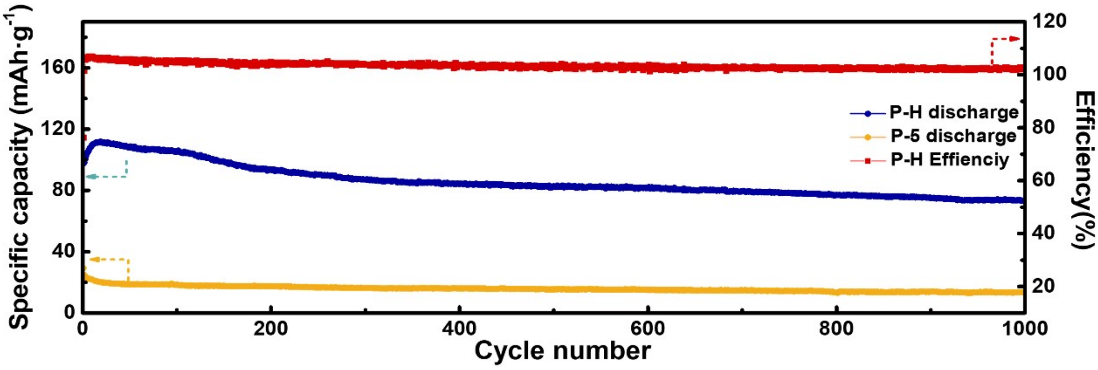

Figure S4. Cycling stability of P-H and P-5 at 1 A·g^{-1} after 1000 cycles.

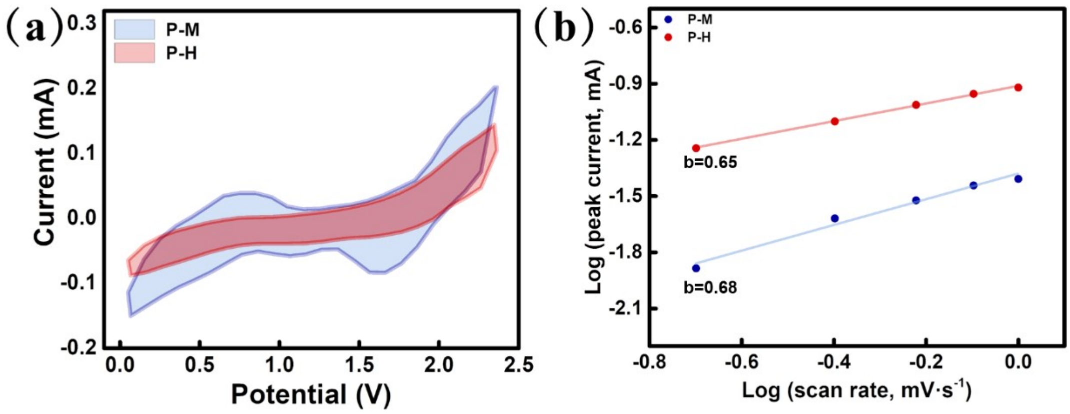

Figure S5. (a) CV curves of P-H and P-M at 1.0 mV/s. (b) b value of P-H and P-M

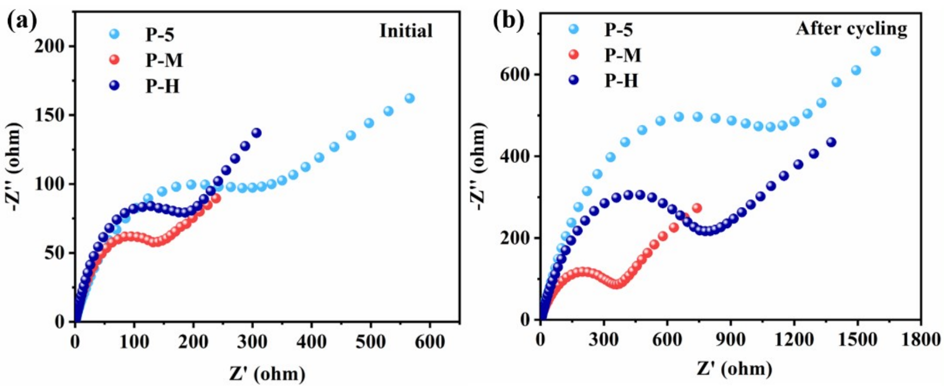

Figure S6. the Nyquist plot of P-5, P-M, and P-H 9 (a) before and (b) after cycling at 500 mA·g^{-1}.

Table S1. Electrical conductivity tests of P-5, P-H, and P-M.

Site	Electrical conductivity (s/cm)		
	P-5	P-H	P-M
Site 1	0.724	1.288	1.292
Site 2	0.721	1.289	1.294
Site 3	0.721	1.290	1.293
Average value	0.722	1.289	1.292

Table S2. Elemental analysis of P-5, P-H, and P-M.

Materials	**Elemental analysis (*at.*%)**		
	C	O	N
P-5	89.6	10.4	-
P-H	94.6	3.36	2.04
P-M	90.23	4.26	5.51

Table S3. Electrical performances of various carbon materials

Materials	Specific capacity/mAh·g^{-1} (I/mA·g^{-1})	Cycling performance		
		Current density (mA·g^{-1})	Cycle number	Capacity (mA h·g^{-1})
P-M	323(500)	1000	1000	109
FNG[1]	300(60)	60	40	225
Natural graphite[2]	110(99)	660	6000	60
EG[3] (expanded graphite)	110(1000)	5000	27500	100
SG[3] (synthetic graphite)	152.5(500)	5000	500	75.5
Nanosheet-bricked PG[4] (porous graphite)	104(1000)	100000	3000	90
CG[5] (commercial graphite)	101(1000)	5000	30000	60
3D GF[6] (graphitic foam)	90(1000)	1200	4000	60
3D GMN[7] (graphene network)	56(3000)	2400	200	57
Defect-free GA[8]	97(50000)	5000	25000	100 ± 3
FLG[9] (few-layer graphene)	173(1000)	10000	5000	78
TLG[10] (three-layer graphene)	197(200)	5000	1000	147
GF@CFC[11] (carbon fiber cloth)	140(100)	3000	300	60
CMK-3[12] (commercial ordered mesoporous carbon)	32(270)	980	36000	28
CMK-8[13]	100.5(300)	2000	30000	46.4
Coconut PAC[14] (porous activated carbon)	150(100)	1000	1500	80
CNF[15] (commercial carbon nanofiber)	95(50000)	10000	20000	105
MoS_2/ MNC[16] (N-doped carbon)	191.2(500)	1000	1700	127.5
NC@ZnSe[17]	172(300)	500	250	60

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