Supporting Information

Defects and sulfur-doping design of porous carbon spheres for high-capacity potassium-ion storage

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Figures

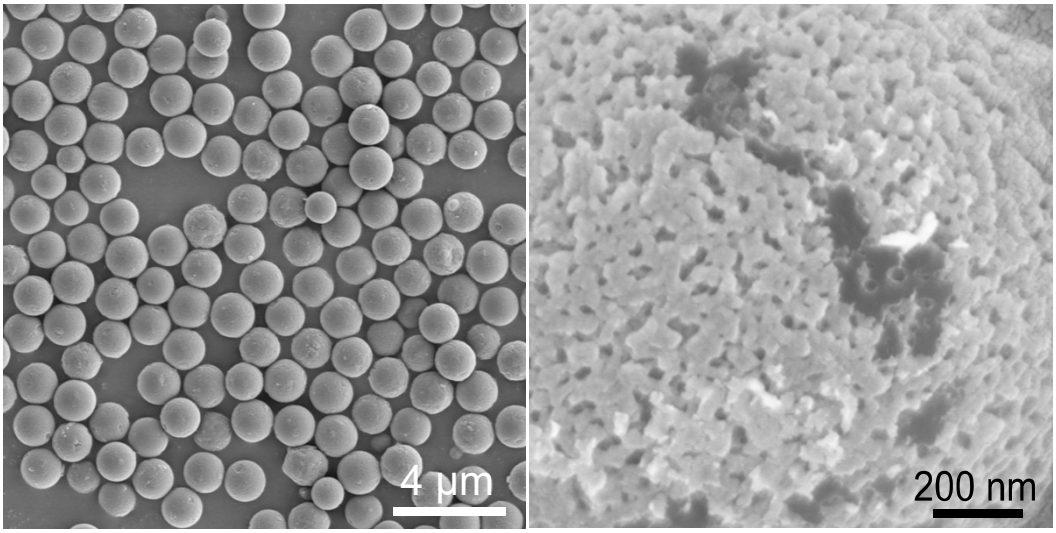


Fig. S1. SEM images of CMSs.

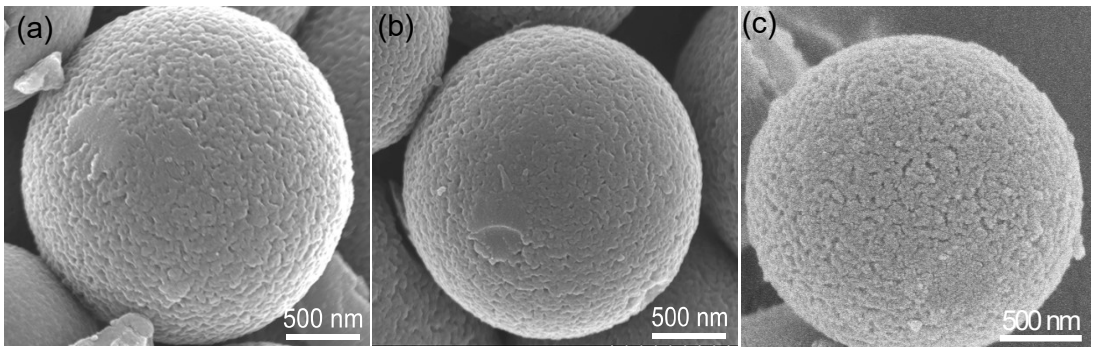
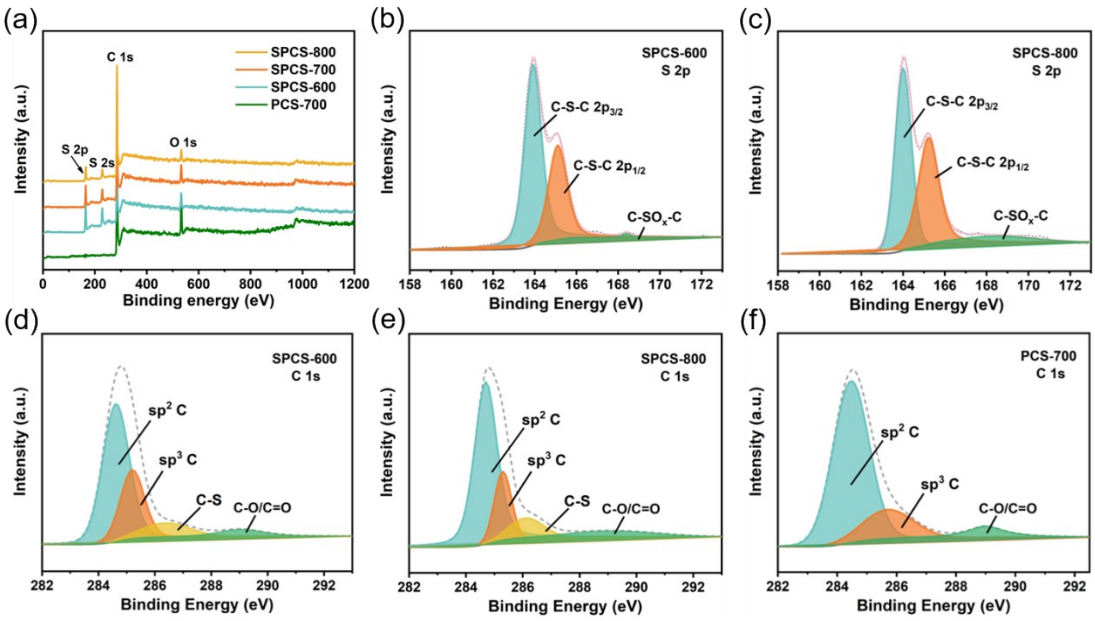


Fig. S2. SEM image of (a) SPCS-600, (b) SPCS-800, and (c) PCS-700.

Fig. S3. (a) XPS full surveys of various SPCS and PCS. S 2p XPS spectrum of (b) SPCS-600 and (c) SPCS-800. C 1s XPS spectrum of (d) SPCS-600, (e) SPCS-800, and (f) PCS-700.



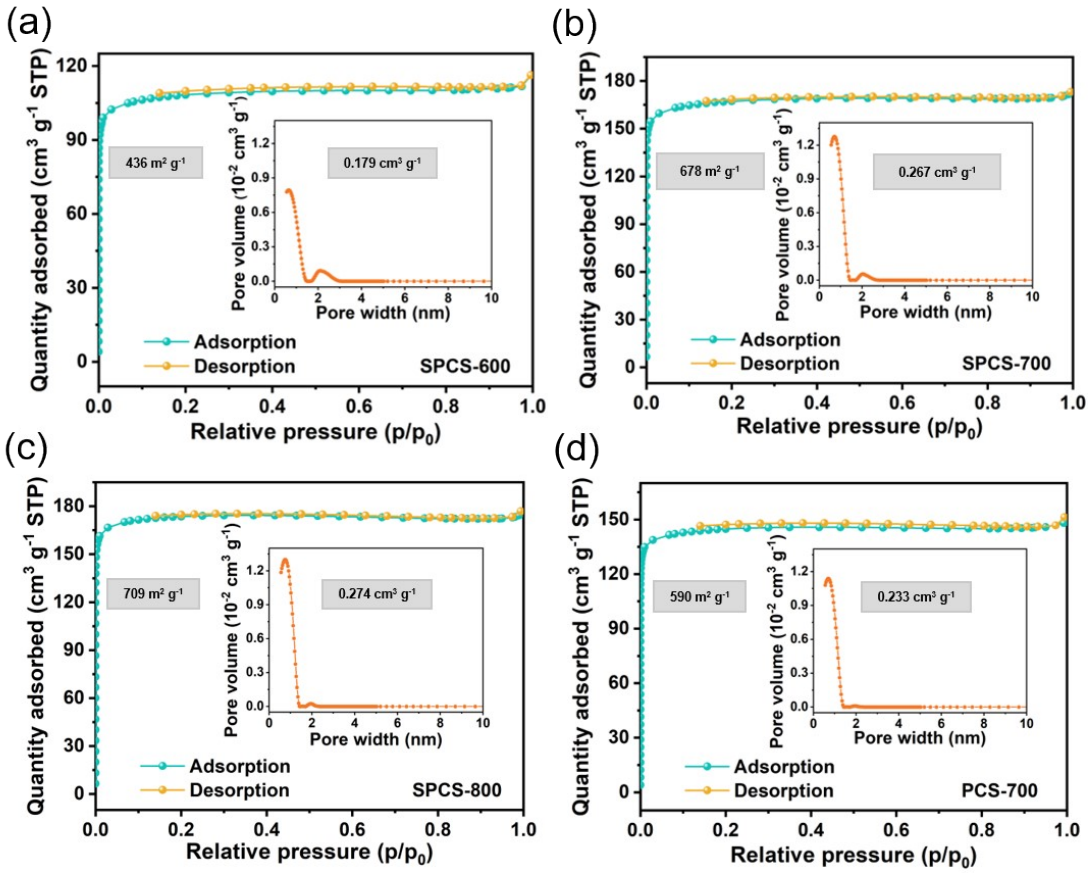


Fig. S4. N_2 adsorption–desorption isotherm curve and pore size distribution (insets) of (a) SPCS-600; (b) SPCS-700; (c) SPCS-800; and (d) PCS-700.

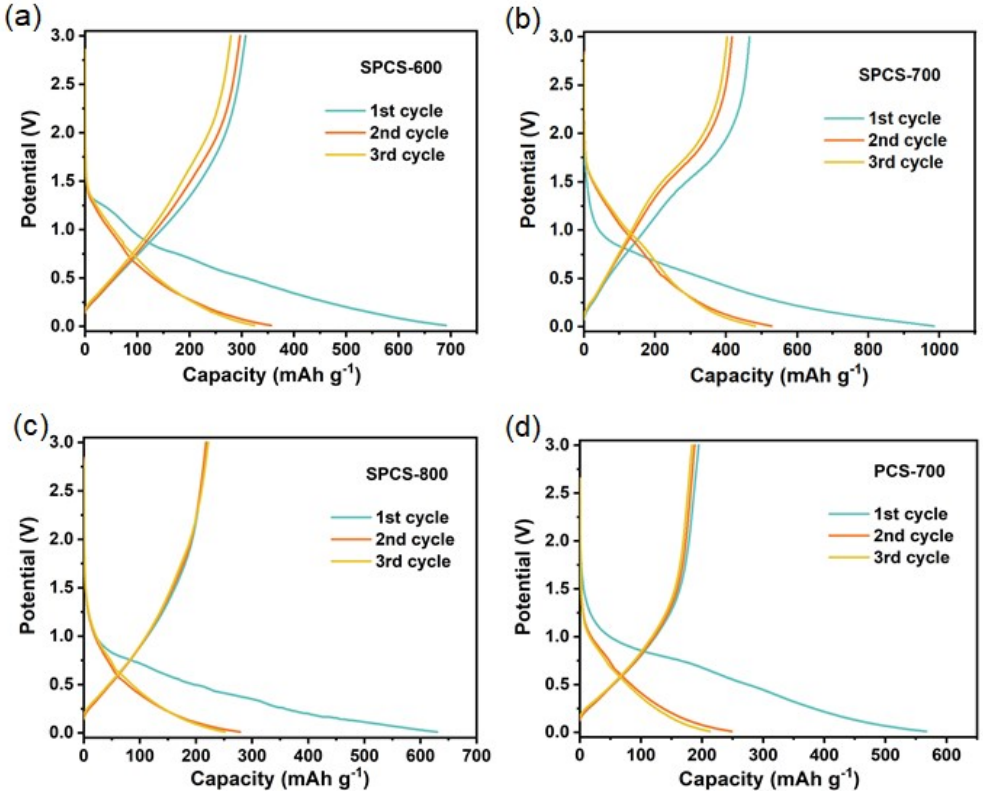


Fig. S5. Electrochemical charge/discharge profiles of (a) SPCS-600 electrode; (b) SPCS-700 electrode, (c) SPCS-800 electrode, and (d) PCS electrode for the initial three cycles at a current density of 50 mA g^{-1}.

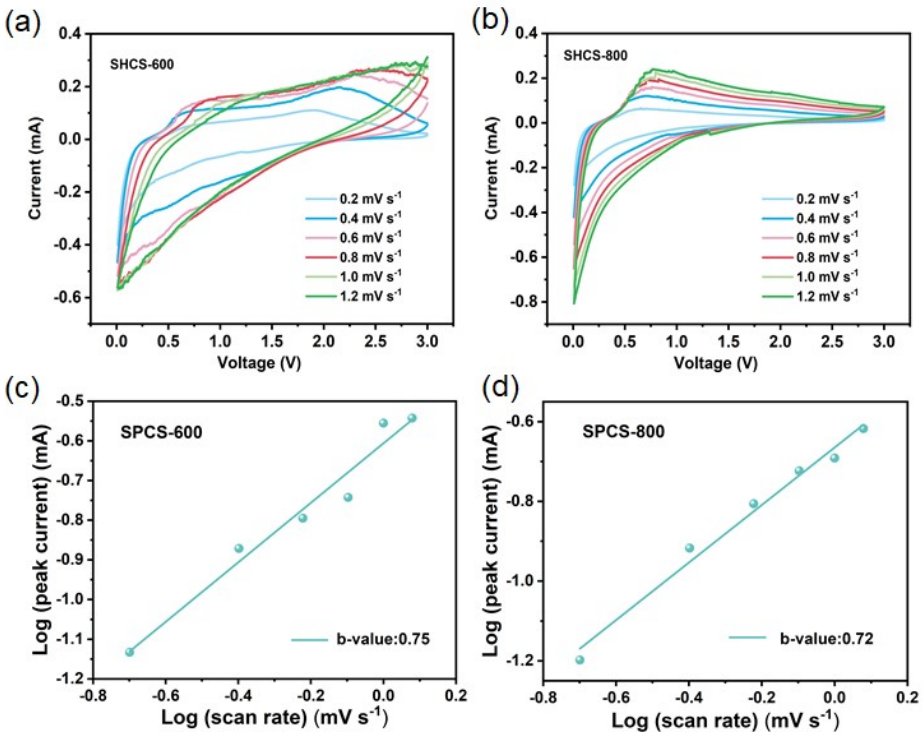


Fig. S6. CV curves of (a) SPCS-600 electrode and (b) SPCS-800 electrode at various scan rates from 0.2 to 1.2 mV s^{-1}. The b-values of (c) SPCS-600 electrode and (d) SPCS-800 electrode.

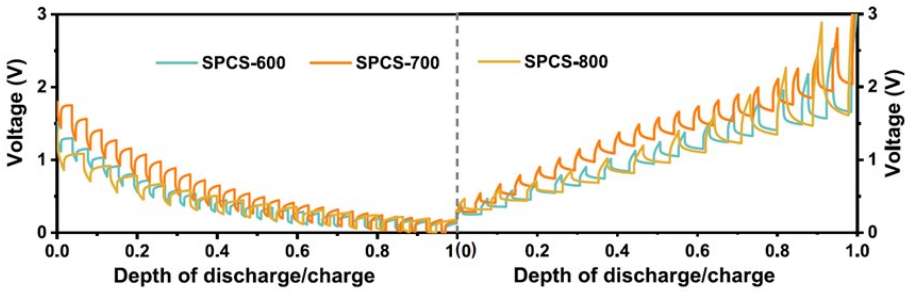


Fig. S7. (a) GITT profiles of various SPCS electrode during the second discharge/charge process.

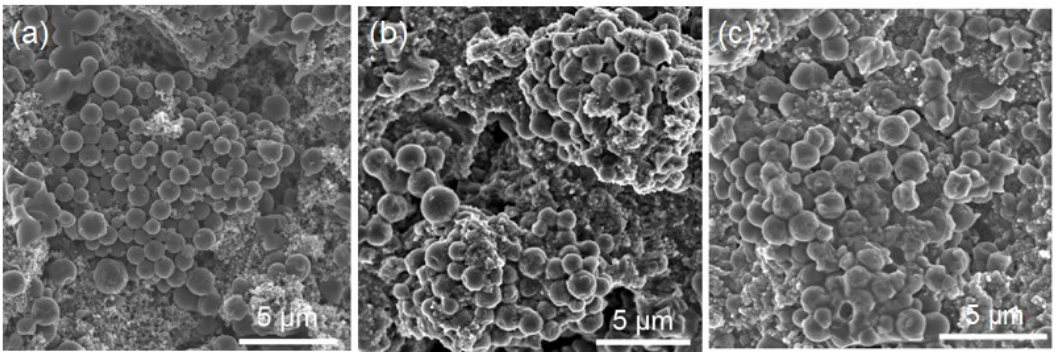


Fig. S8. SEM images of SPCS-700 electrode: (a) before the first cycle; and (b) after 100 cycles. (c) SEM images of PCS electrode after 100 cycles.

Table S1. Physical parameters for various SPCS and PCS-700.

Samples	S_{BET} [$m^2 g^{-1}$]	V_t [$cm^3 g^{-1}$]	d_{002} [nm]	XPS composition [wt%]		
				C	O	S
SPCS-600	436	0.179	0.376	81.52	6.92	11.56
SPCS-700	678	0.267	0.387	84.23	7.31	8.46
SPCS-800	709	0.274	0.395	88.82	4.97	6.21
PCS-700	590	0.233	-	88.43	11.57	-

Table S2. Potassium storage performance of SPCS-700 compared with previously reported materials.

Materials	Reversible Capacity & Rate capability	Cyclability	Ref.
SPCS-700	406 mAh g^{-1} @ 50mA g^{-1} 216 mAh g^{-1} @ 1000mA g^{-1}	188.9 mAh g^{-1}/1000 cycles @ 0.5 A g^{-1}	This work
S/O-codoped porous hard carbon microspheres	226.6 mAh g^{-1} @ 50mA g^{-1} 158 mAh g^{-1} @ 1000mA g^{-1}	108.4 mAh g^{-1}/2000 cycles @ 1 A g^{-1}	1
Hierarchically porous thin carbon shells	235 mAh g^{-1} @ 100 mA g^{-1} 64 mAh g^{-1} @ 4000 mA g^{-1}	65 mAh g^{-1}/900 cycles @ 2 A g^{-1}	2
N-doped porous hollow carbon spheres	280 mAh g^{-1} @ 28 mA g^{-1} 134 mAh g^{-1} @ 5600 mA g^{-1}	154 mAh g^{-1}/500 cycles @ 1.4 A g^{-1}	3
N/O-codoped porous hard carbon	365 mAh g^{-1} @ 25 mA g^{-1} 118 mAh g^{-1} @ 3000 mA g^{-1}	230 mAh g^{-1}/100 cycles @ 0.05 A g^{-1}	4
Hard-soft composite carbon	230 mAh g^{-1} @ 140 mA g^{-1} 167 mAh g^{-1} @ 1400 mA g^{-1}	200 mAh g^{-1}/200 cycles @ 0.28 A g^{-1}	5
N/O-codoped hard carbon	304.6 mAh g^{-1} @ 100 mA g^{-1} 178.9 mAh g^{-1} @ 5000 mA g^{-1}	189.5 mAh g^{-1}/5000 cycles @ 1 A g^{-1}	6
Mesoporous carbon	286.4 mAh g^{-1} @ 50 mA g^{-1} 144.2 mAh g^{-1} @ 1000 mA g^{-1}	146.5 mAh g^{-1}/1000 cycles @ 1 A g^{-1}	7
S/N-codoped hard carbon	276 mAh g^{-1} @ 100 mA g^{-1} 174 mAh g^{-1} @ 3000 mA g^{-1}	213.7 mAh g^{-1}/500 cycles @ 0.1 A g^{-1}	8
N/S-codoped graphene nanosheets	348.2 mAh g^{-1} @ 50 mA g^{-1} 204.3 mAh g^{-1} @ 2000 mA g^{-1}	203 mAh g^{-1}/500 cycles @ 1 A g^{-1}	9
Soft carbon	273 mAh g^{-1} @ ~7 mA g^{-1} 140 mAh g^{-1} @ 1395 mA g^{-1}	150.6 mAh g^{-1}/50 cycles @ 0.558 A g^{-1}	10
N/O-codoped carbon network	382 mAh g^{-1} @ 50 mA g^{-1} 181 mAh g^{-1} @ 2000 mA g^{-1}	160 mAh g^{-1}/4000 cycles @ 1 A g^{-1}	11
Carbon nanofiber foam	240 mAh g^{-1} @ 50 mA g^{-1} 164 mAh g^{-1} @ 1000 mA g^{-1}	158 mAh g^{-1}/2000 cycles @ 1 A g^{-1}	12
porous N-doped carbon fibers	197 mAh g^{-1} @ 50 mA g^{-1} 57 mAh g^{-1} @ 250 mA g^{-1}	65 mAh g^{-1}/346 cycles @ 0.1 A g^{-1}	13

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