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Supporting Information

Nanoporosity of Carbon–Sulfur Nanocomposites toward the Lithium–Sulfur Battery Electrochemistry

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Table S1. Morphological properties of carbon blacks.

	Nonporous carbon	Microporous carbon	Micro/mesoporous carbon	Macroporous carbon
Specific surface area (m^2 g^{-1})	79	1435	1301	239
Particle size (nm)	40	35	35	50
Total pore volume (cm^3 g^{-1})	0.10	3.30	2.09	1.11
Average pore diameter (nm)	5.09	9.20	6.42	18.52
Micropore surface area (m^2 g^{-1})	0.00	760	77	63
Micropore volume (cm^3 g^{-1})	0.00	0.38	0.03	0.03

Table S2. Material analysis of C–S nanocomposites.

	Nonporous carbon	Microporous carbon	Micro/mesoporous carbon	Macroporous carbon
Weight loss (wt%) by TGA	78.7	80.7	81.3	78.7
Sulfur (wt%) by EA	79.2	80.2	80.0	79.9
Carbon (wt%) by EA	19.2	18.0	18.1	18.6
Nitrogen / oxygen / hydrogen (wt%) by EA	1.6	1.8	1.9	1.5

Table S3. Electrochemical performance of C–S nanocomposites.

	Nonporous carbon	Microporous carbon	Micro/mesoporous carbon	Macroporous carbon
Cyclability test C/10 the 1st discharge capacity	1036	1084	1078	831
Rate capability test C/20 the 10th discharge capacity	1160	1059	998	718
Rate capability test C/10 the 10th discharge capacity	1001	944	868	667
Rate capability test C/5 the 10th discharge capacity	894	819	718	612

Rate capability test C/3 the 10th discharge capacity	319	720	622	581
Rate capability test C/20 the 10th discharge capacity	un-cyclable	887	849	667

Table S4. Comparative analysis of the battery performances and electrochemical characteristics of the C–S composite cathodes in the Li–S research.

Sulfur loading (mg cm^{-2})	Sulfur content (wt%)	Electrolyte-to-sulfur ratio (μL mg^{-1})	Cycling rate	Cycle life	Highest capacity (mA h g^{-1})	Areal capacity (mA h cm^{-2})	Reference
0.9	54	20	5C	400	450	0.41	[1]
1.1	52.2	15	C/2	200	955	1.05	[2]
2.4	51	11	1C	300	732	1.76	[3]
3.4	64	18.2	2C	500	932	3.17	[4]
2	49	n/a	C/2	500	715	1.43	[5]
1.4	48	25	1.5C	400	600	0.84	[6]
2	58	15	C/2	200	992	1.98	[7]
3.3	48.8	61	C/2	200	1000	3.30	[8]
1.3	56	n/a	C/2	300	750	0.98	[9]
1.5	73.6	20	C/5	100	900	1.35	[10]
1	70	n/a	C/5	100	1,343	1.34	[11]
1	70	n/a	C/2	100	1,544	1.54	[11]
1.3	49	7	C/10	100	1,150	1.50	[12]
3.9	62	20	C/10	100	1,322	5.15	[13]
3.9	62	20	C/2	200	980	3.82	[13]
3.2	73.2	n/a	C/10	500	1,540	4.93	[14]
2.46	50	16	C/2	100	1,343	3.30	[15]
2	69.6	n/a	C/5	400	997	1.99	[16]

2.4	70	n/s	3C	1000	641	1.51	[17]
1	58	n/a	C/2	200	1,040	1.04	[18]
1.2	72	12	C/2	250	906	1.09	[19]
2	72	12	C/2	250	760	1.52	[19]
4	72	12	C/2	500	616	2.46	[19]
1.5	55.5	n/a	C/5	600	912	1.37	[20]
4	80	10	C/10	100	1,036	4.14	This work
4	80	10	C/10	100	1,084	4.34	This work
4	80	10	C/10	100	1,078	4.31	This work
4	80	10	C/10	100	831	3.33	This work

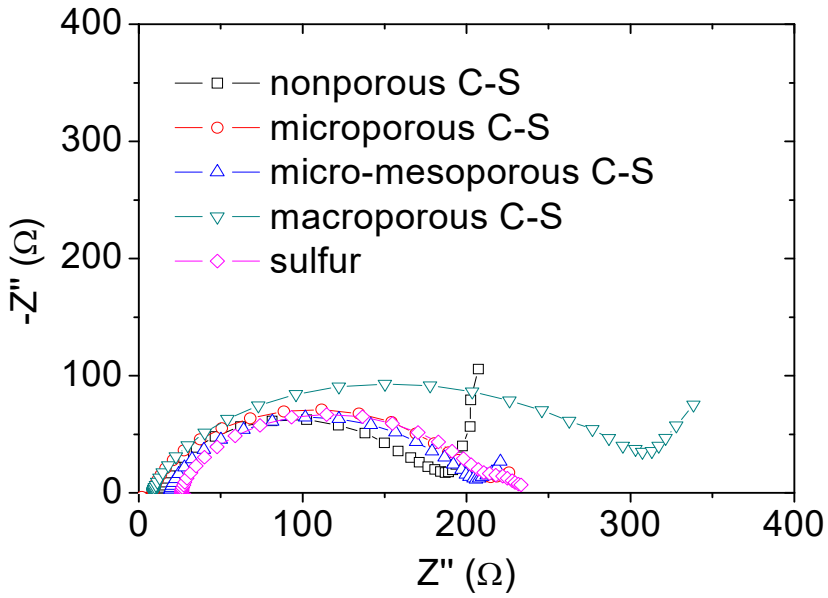


Figure S1. Electrochemical impedance analysis of C–S nanocomposites.

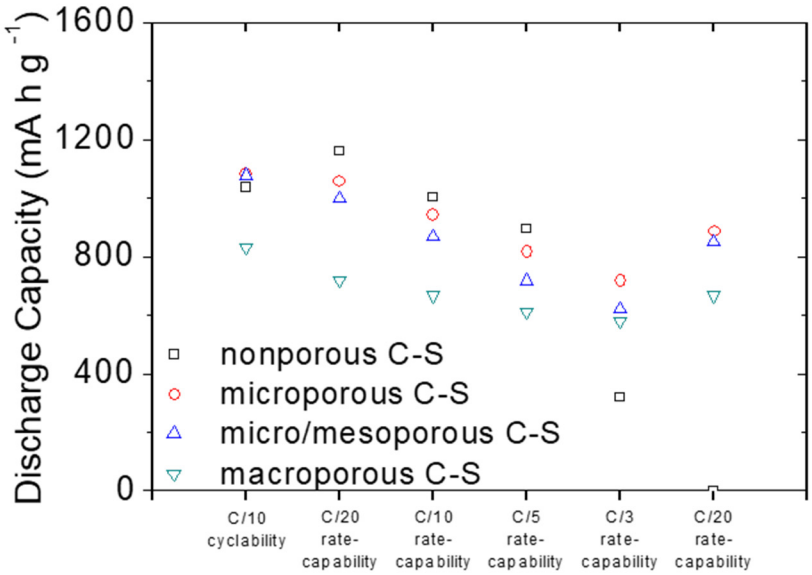


Figure S2. The effect of nanoporosity of C–S nanocomposites toward their corresponding electrochemical performance (*i.e.*, cyclability at the C/10 rate with the initial discharge capacity, and the rate capability at C/20–C/3 rates with the capacity at the tenth cycle in each rate).

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