

Supporting Information for

Design considerations for lithium-sulfur batteries: mass transport of lithium polysulfides

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1. Supplementary results and discussion

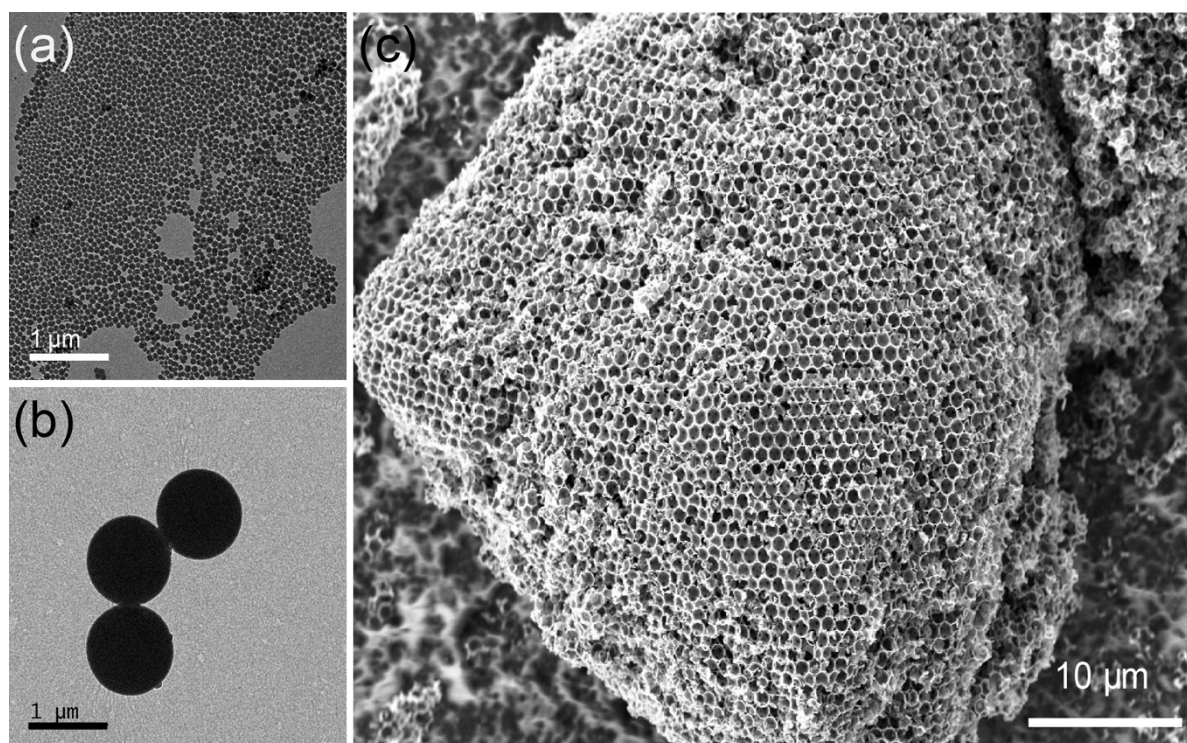


Fig. S1 TEM images of (a) 100 nm SiO_2 nanoparticles and (b) 1 μm SiO_2 nanoparticles. (c) Large-area SEM image of C1000.

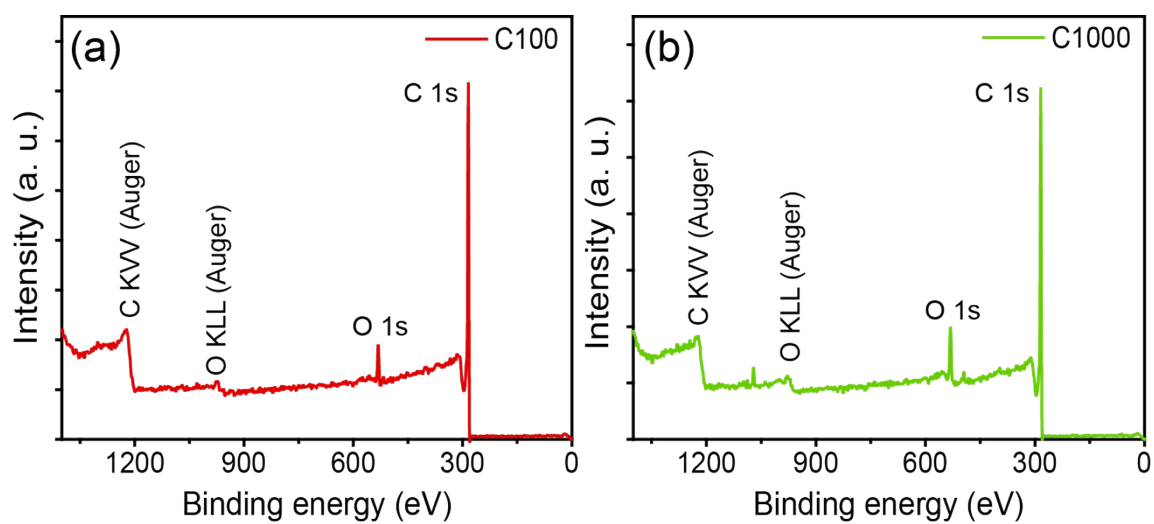


Fig. S2 XPS survey spectra of (a) C100 and (b) C1000.

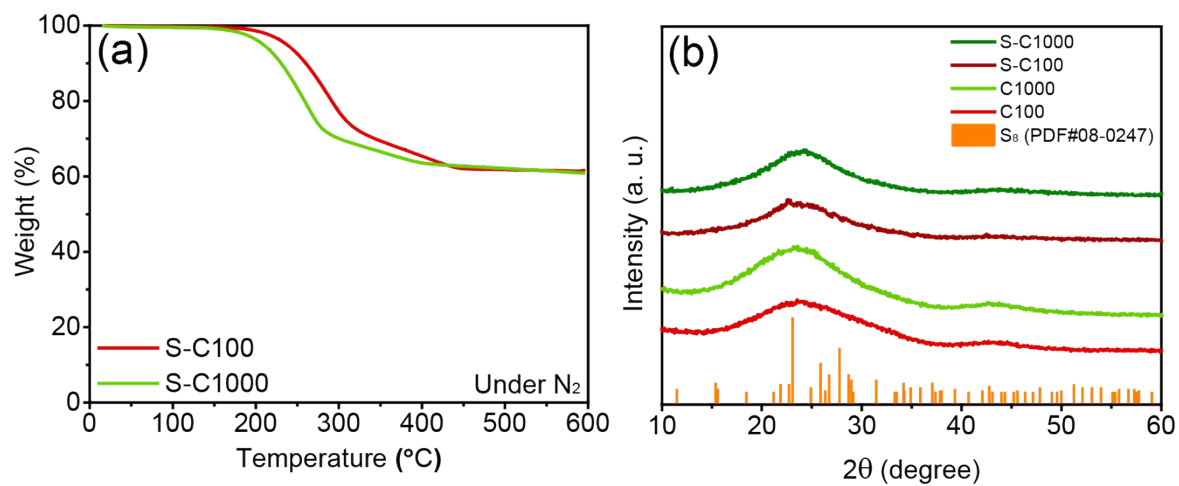


Fig. S3 (a) TGA curves of S-C100 and S-C1000 under nitrogen atmosphere. (b) XRD patterns of S-C100, S-C1000, C100 and C1000.

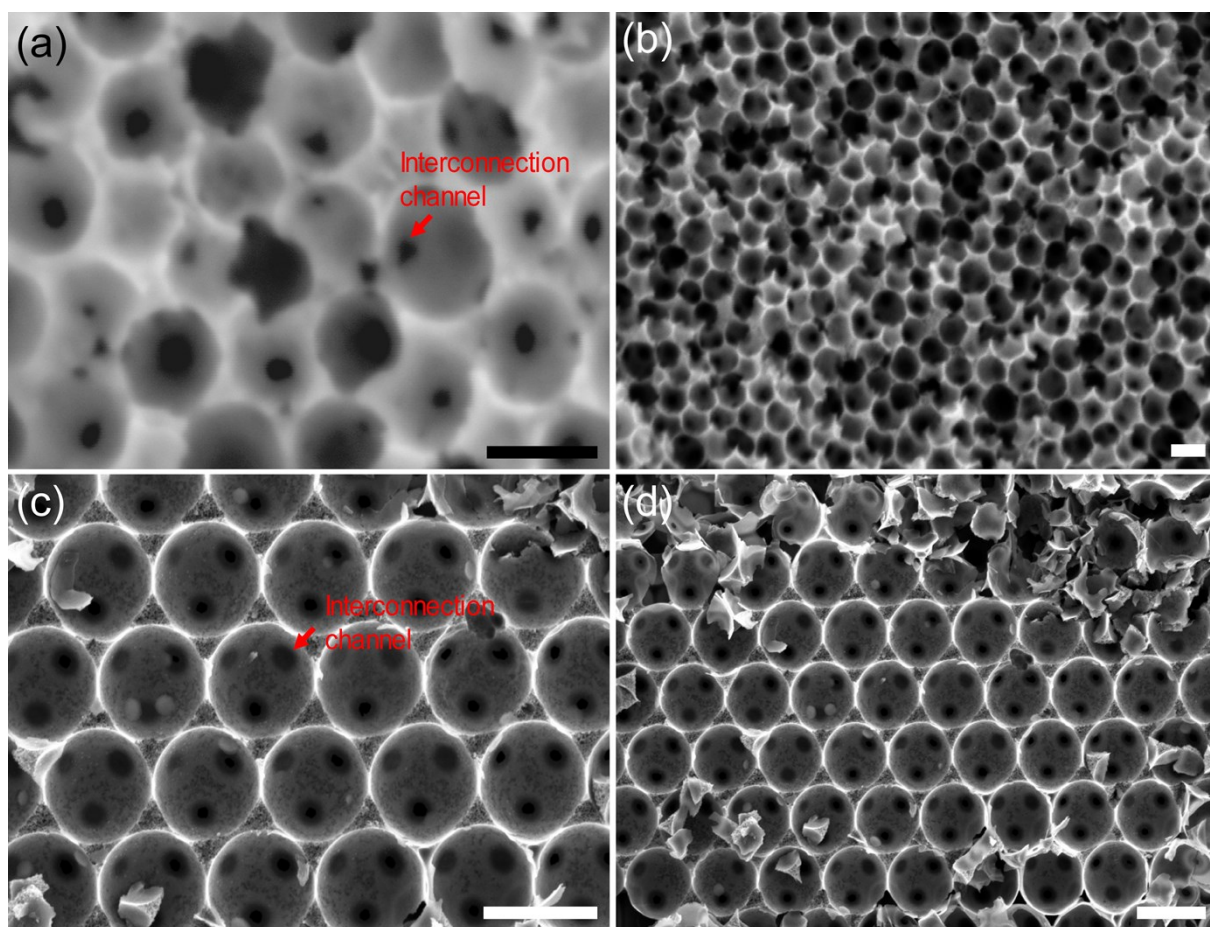


Fig. S4 SEM images of (a, b) S-C100 and (c, d) S-C1000. The red arrows indicate the interconnection channel. Scale bars are 100 nm in (a, b) and 1 μ m in (c, d).

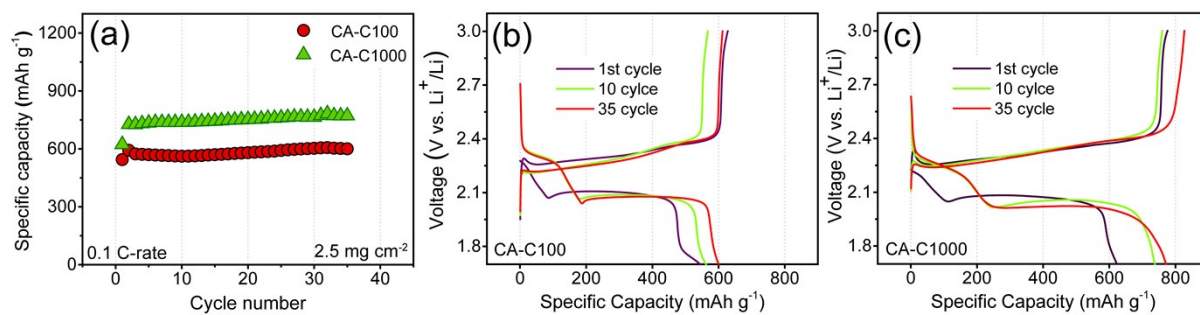


Fig. S5 (a) Cycle performance of CA-C100 and CA-C1000 for 35 cycles at 0.1 C-rate having 2.5 mg cm⁻² sulfur loading. Voltage profiles of (b) CA-C100 and (c) CA-C1000 at the first cycle, 10th cycle and 35th cycle.

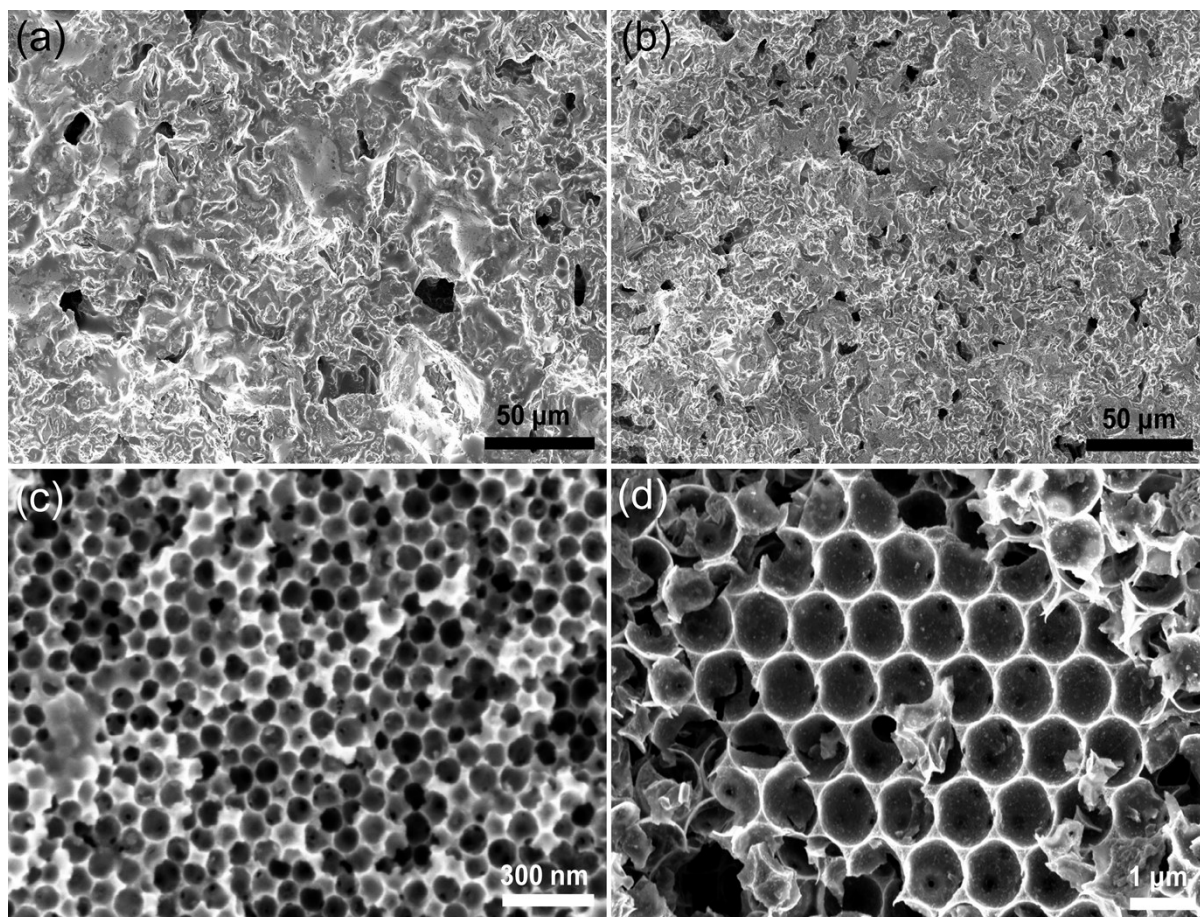


Fig. S6 SEM images of (a, b) CA-C100 and CA-C1000 before cycling and (c, d) CA-C100 and CA-C1000 after 10 cycles at 0.2 C-rate.

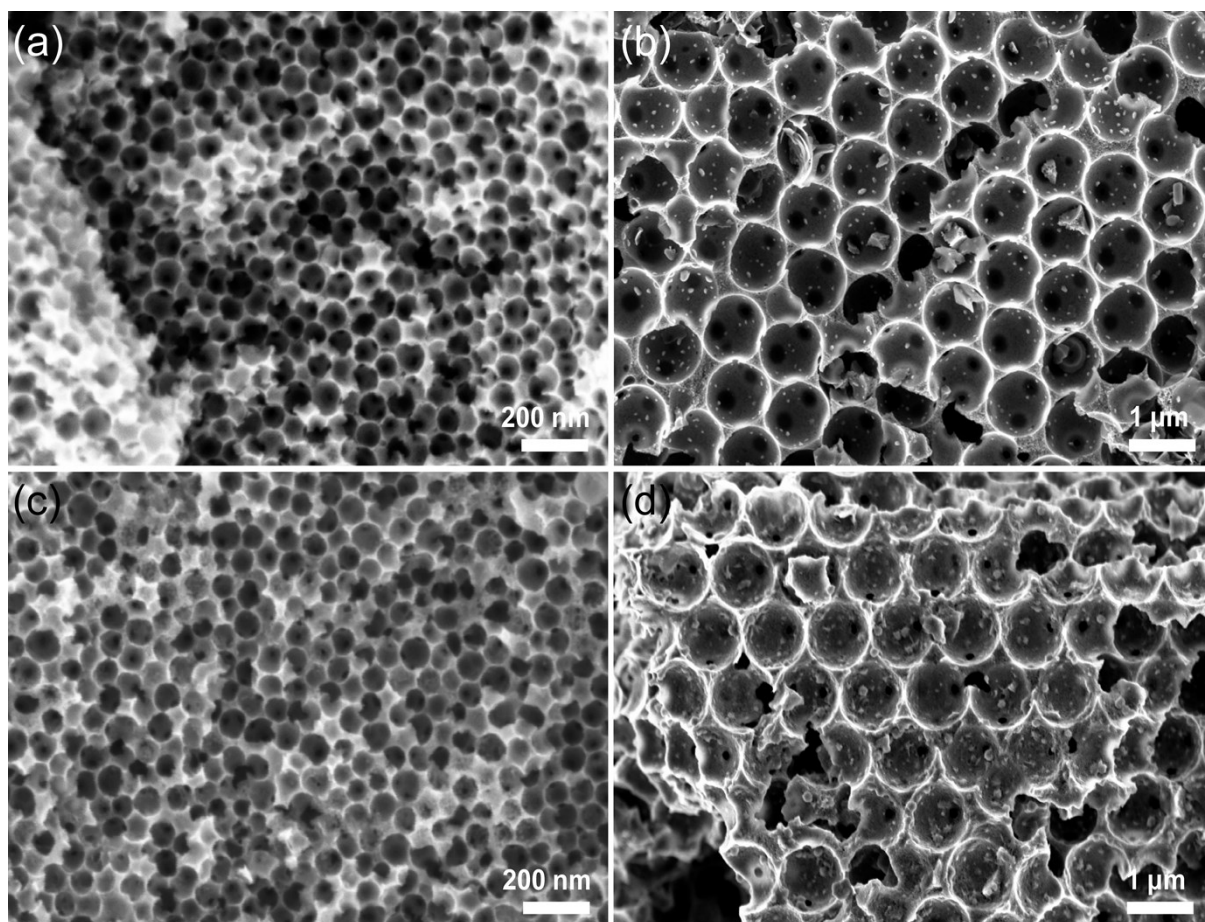


Fig.S7 SEM images of (a, b) S-C100 and S-C1000 before cycling and (c, d) S-C100 and S-C1000 after 10 cycles at 0.2 C-rate.

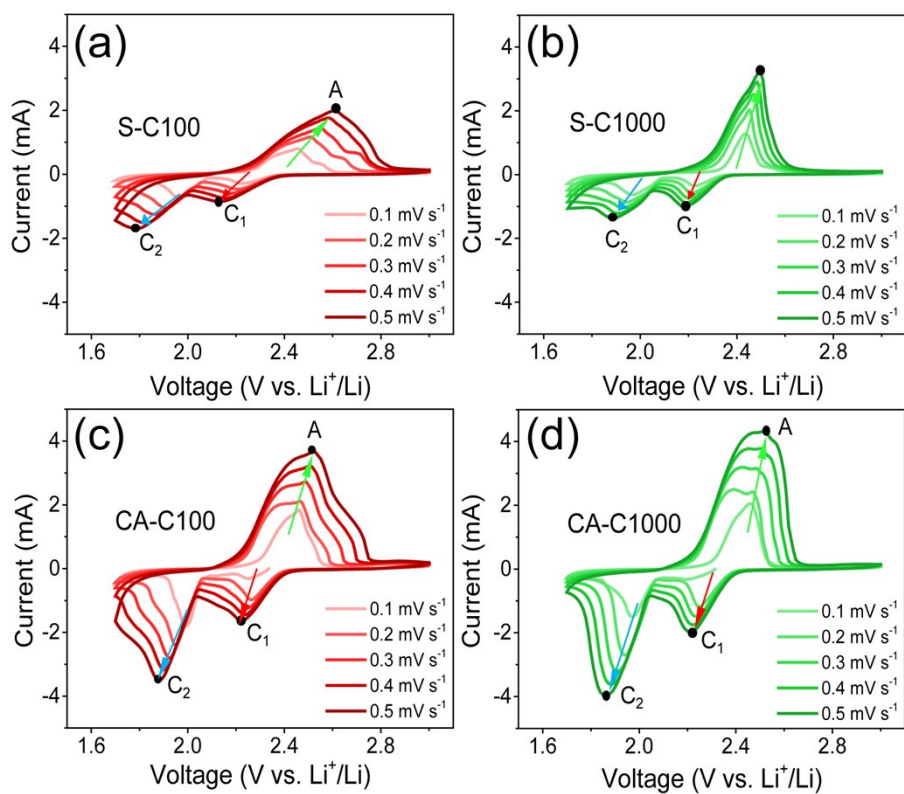


Fig. S8 CV profiles at varying scan rates ($0.1\text{--}0.5\text{ mV s}^{-1}$) of (a) S-C100 and (b) S-C1000 using melt diffusion method and (c) CA-C100 and (d) CA-C1000 under catholyte system at the range of $1.7\text{--}3.0\text{ V vs. Li}^+/\text{Li}$.

Diffusion coefficient ($\times 10^6 \text{ cm}^2 \text{ s}^{-1}$)	S-C100	S-C1000	CA-C100	CA-C1000
C_1 ($\text{S}_8/\text{Li}_2\text{S}_8 \rightarrow \text{Li}_2\text{S}_4$)	0.253	0.328	1.27	1.98
C_2 ($\text{Li}_2\text{S}_4 \rightarrow \text{Li}_2\text{S}$)	0.713	0.418	2.21	4.50
A ($\text{Li}_2\text{S} \rightarrow \text{S}_8$)	1.10	2.88	2.89	4.15

Table S1. Diffusion coefficient of S-C100, S-C1000, CA-C100 and CA-C1000 at different reaction region.