

Supplemental Information for Solid-Liquid-Solid Mediated Artificial SEI Coated Stable Lithium and High-Sulfur Percentage SPAN for High Performance Li-S Batteries

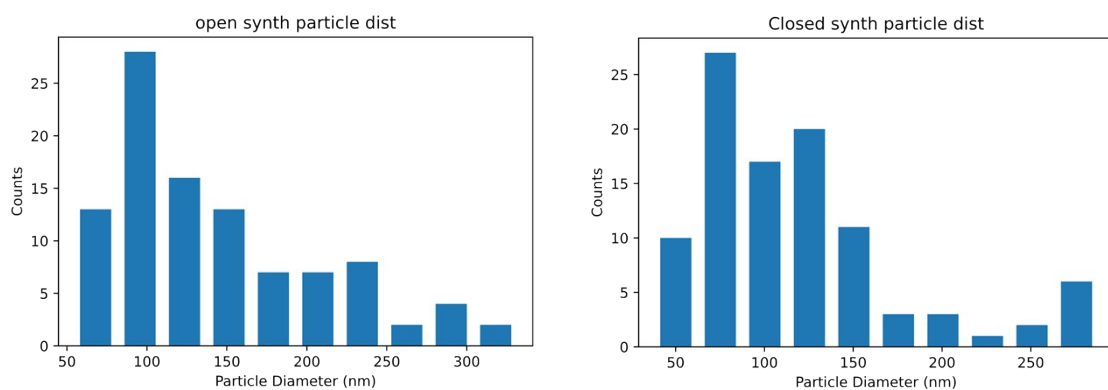
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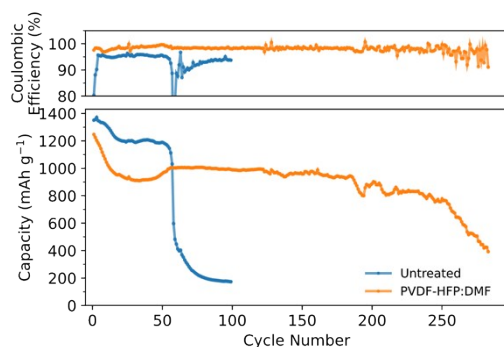
Table S1. Elemental analysis showing the weight percent of elements of carbonized PAN and synthesized SPAN via open and closed methods

Wt. %	N %	C %	S %
PAN	22.24	62.73	0
SPAN (open)	14.66	33.80	45.30
SPAN (closed w/ Co doped)	13.28	31.91	53.62



Distribution of particle diameter in (a) an open system and (b) a closed system, using a sample size of $n=100$.

The individual particles in both systems have diameters around 100 nm, but the open system has more particles in the 100 to 150 nm range (**Fig. S1**). The open system also has more agglomerations that range up to 350 nm, whereas the closed system has far fewer of these large agglomerations.



The treated pouch cell had an initial capacity of 1,166 mAh g⁻¹ (988 mAh g⁻¹ after the capacity stabilizes) and 966 mAh g⁻¹ after 150 cycles. This represents a capacity retention of 83% (or 98%).

Method for Capacity Calculations

Capacity is reported in mAh g⁻¹. We report grams with respect to grams of SPAN or sulfur in the cathode. The exported data from our cell cycler gives us a value for mAh per cycle. We divide this number based on the mass of SPAN or sulfur present in the cell. The amount of sulfur can be calculated based on the sulfur percentage in the SPAN material.

Example SPAN Calculation:

Value from exported data: 50 mAh

SPAN active material: 100 mg SPAN = .100 g SPAN

$$\frac{50 \text{ mAh}}{0.100 \text{ g SPAN}} = 500 \text{ mAh g}_{SPAN}^{-1}$$

Example Sulfur Calculation:

Value from exported data: 50 mAh

SPAN active material: 100 mg SPAN = .100 g SPAN

53.62% Sulfur content in SPAN: 100 mg SPAN * 0.5362 = 53.62 mg Sulfur = .05362 g Sulfur

$$\frac{50 \text{ mAh}}{0.05362 \text{ g Sulfur}} = 932 \text{ mAh g}_{Sulfur}^{-1}$$