Supporting Information

Organic-Inorganic Composite Separator for Preventing Shuttle Effect in Lithium Sulfur Battery

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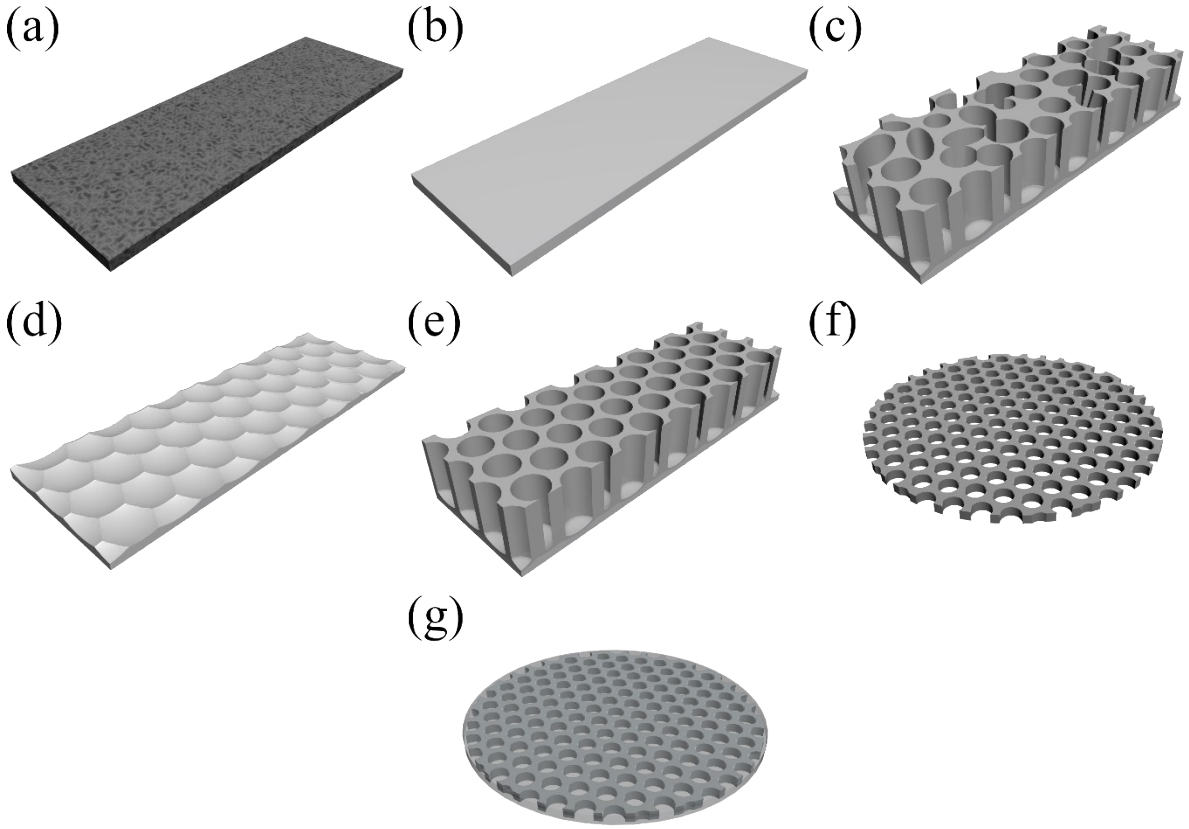

Fig. S1 Fabrication process of AAO and PAAO separators: (a)aluminum foil, (b)aluminum after electrochemical polish, (c)after first anodization, (d)aluminum after remove first anodizing aluminum oxide layer, (e)after second anodization, (f)AAO separator: after remove the barrier layer, (g)PAAO separator: after coating with PVdF-HFP in AAO separator

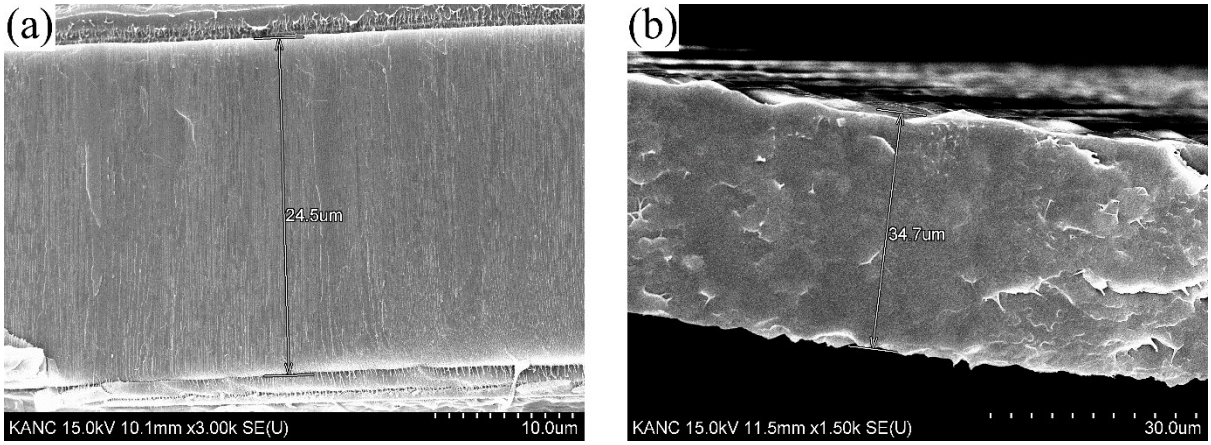

Fig. S2 Cross section image of the (a) AAO separator and (b) PAAO separator. The thickness of AAO was about 25um and PAAO was 35um

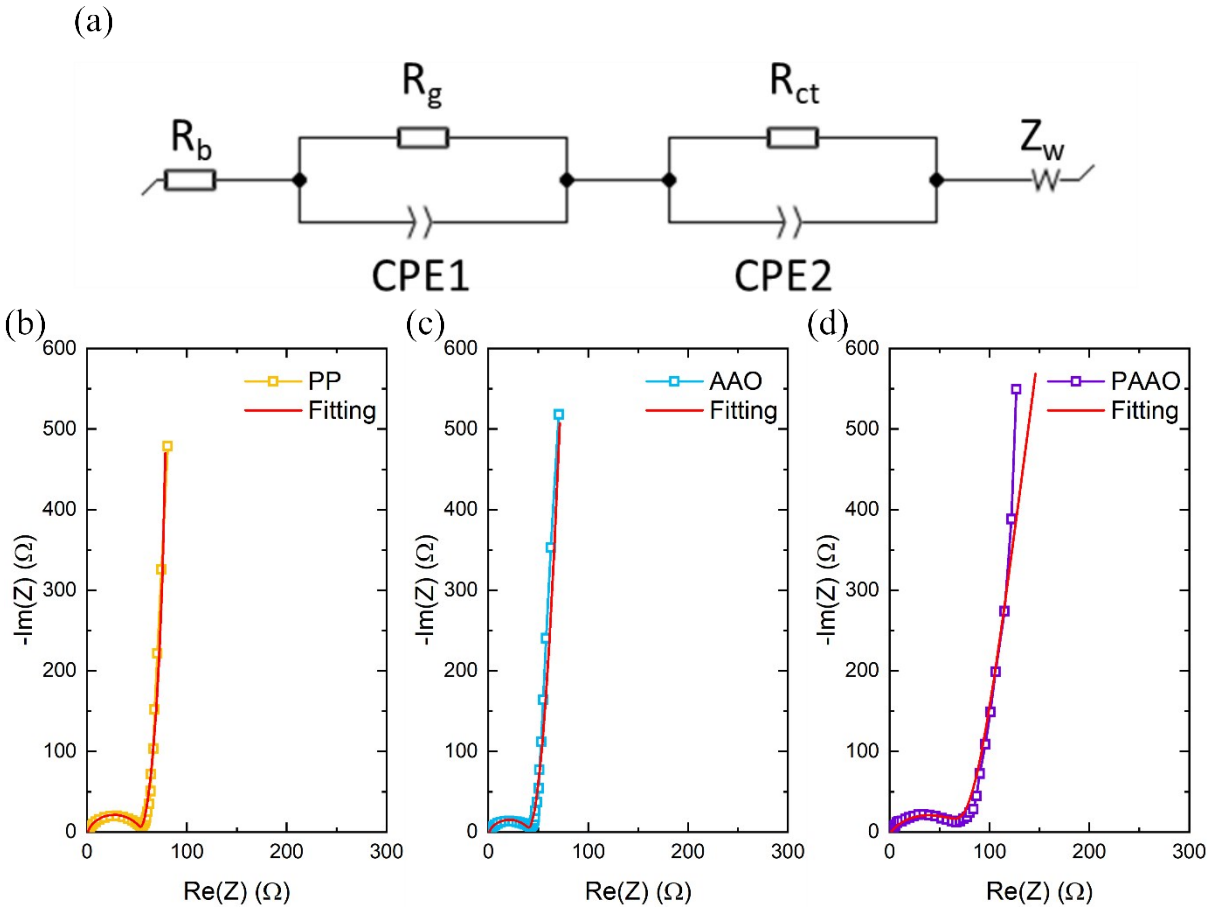

Fig. S3 (a) Equivalent circuit and impedance spectroscopy and equivalent circuit fitting data for each separator; (b) PP, (c) AAO, and (d) PAAO.

	PP	**AAO**	**PAAO**
$\mathbf{R_b}$	1.48	1.36	1.77
$\mathbf{R_{ct}}$	53.6	40.3	70.2

Table S1. Bulk resistance and charge transfer resistance of each separators.

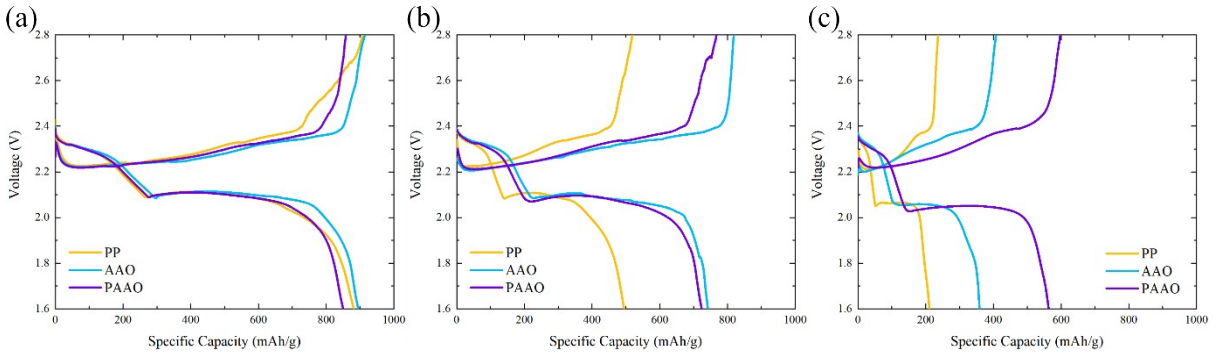

Fig. S4 Voltage profile of lithium sulfur cell with each separator. (a) 0.2C first formation cycle, (b) 0.5C first cycle, (c) 0.5C 100th cycle

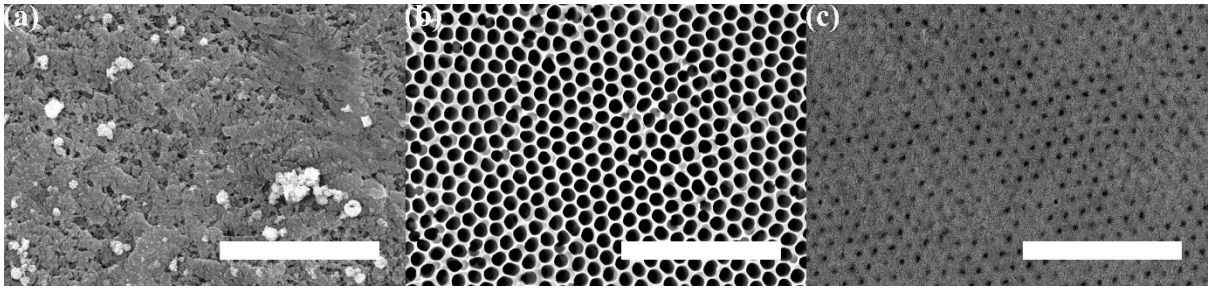

Fig S5. SEM image (scale bar size 1 um) of separator after cycling test. (a) PP separator, (b) AAO separator, (c) PAAO separator.

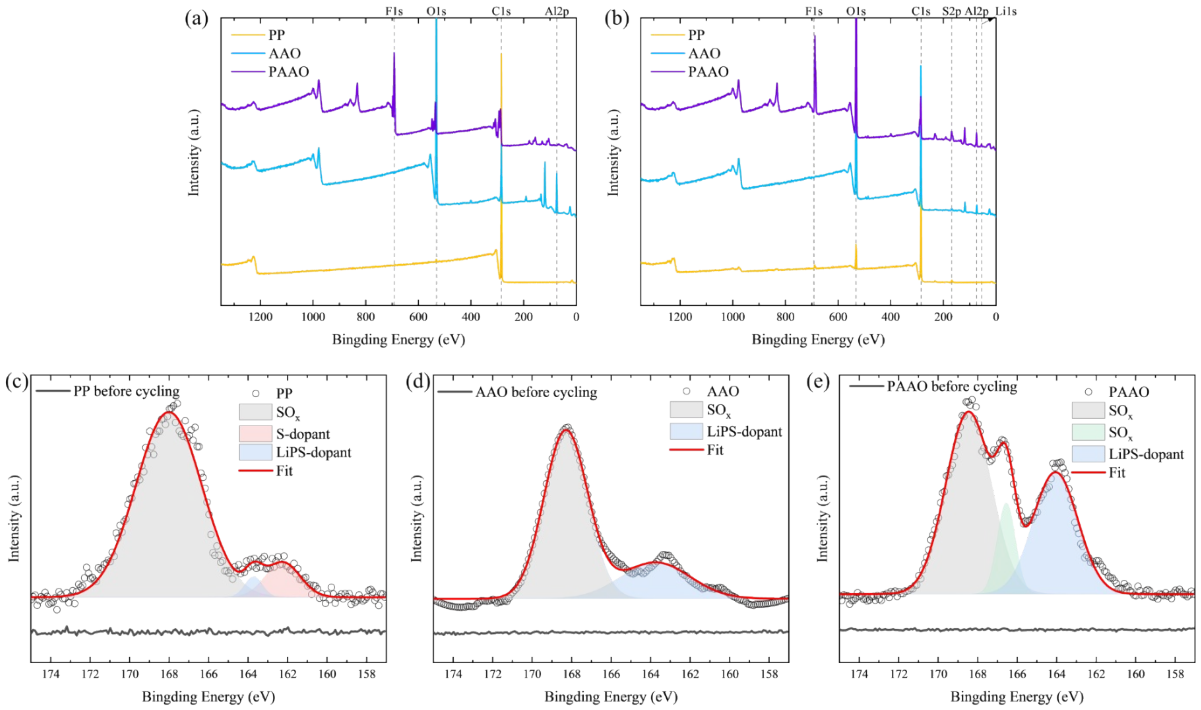

Fig S6. XPS data of separator. (a)before cycling test, (b)after cycling test, S 2p fitted peak of (c)PP separator, (d)AAO separator, (e)PAAO separator.

Fig. S7 Optic image of DME/DOL electrolyte (left) with lithium polysulfide (right) without lithium polysulfide.

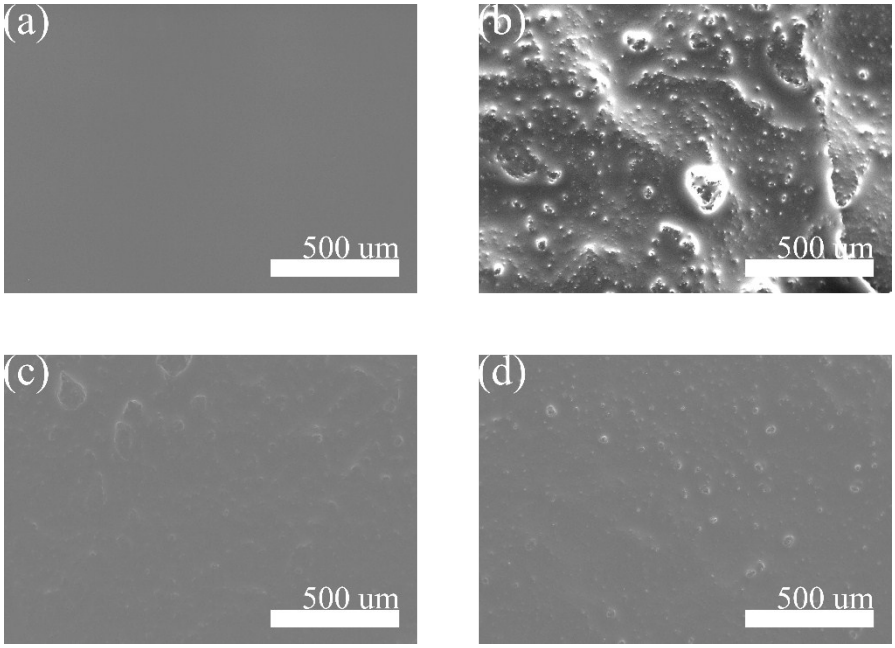

Fig. S8 SEM image of lithium metal anode of before and after cell test; (a) fresh lithium metal anode, cycled lithium with (b) PP separator, (c) AAO separator, (d) PAAO separator.

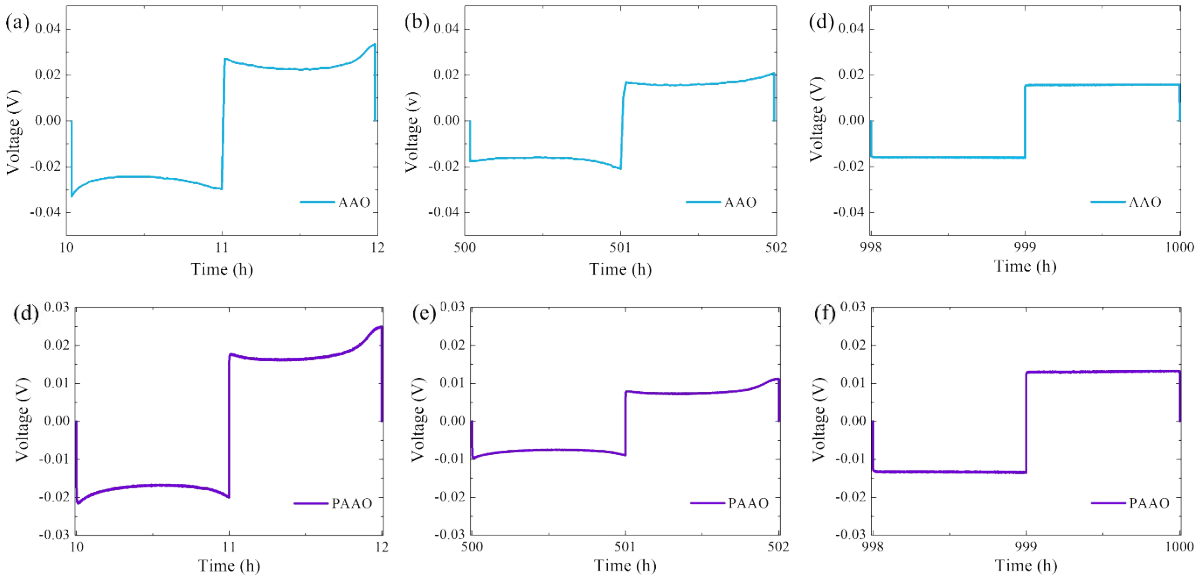

Fig. S9 The voltage profile of Li symmetric cell with AAO and PAAO separators at 1 mA cm^{-2}, 1 mAh cm^{-2}.