Supplementary Information

Improving the Li-S battery performance by applying a combined interface engineering approach on the Li_2S cathode

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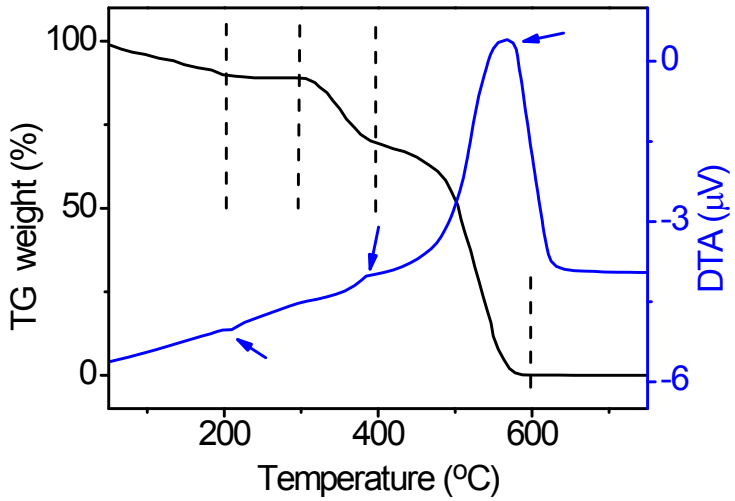

Fig. S1. The TGA/DTA curves of SPEEK. Before 200 °C, there is weight loss of 11 wt%, which can be assigned to the loss of water trapped in the polymer. Between 200 °C and 300 °C, there is no weight loss. The polymer keeps stable at this temperature range. Between 300 °C and 400 °C, there is another weight loss of ~20 wt%. The sulfonate groups are lost in this temperature range. The decomposition of the polymer backbone happens between 400 °C and 600 °C with weight loss of ~70 wt%. Compared to the melting temperature of below 200 °C for both the anode and the separator, the thermal stability of SPEEK is significantly higher and can meet the requirements of Li-S batteries.

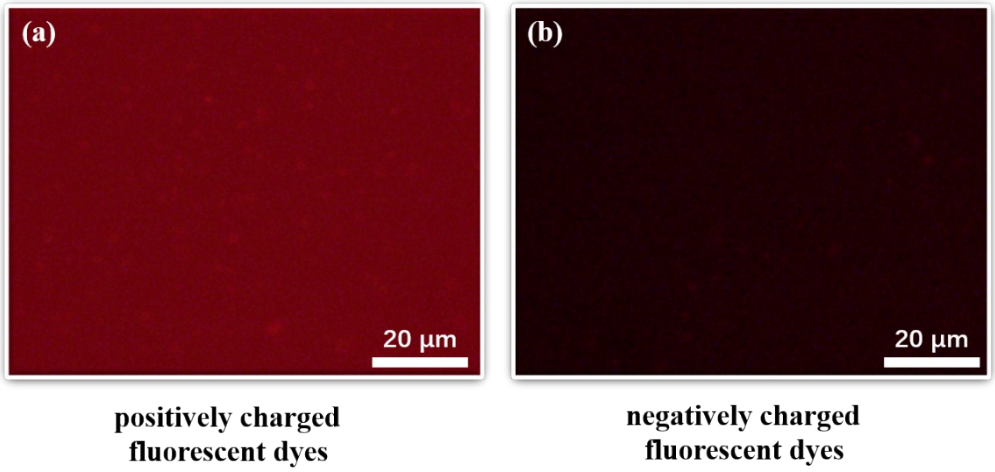

Fig. S2. The confocal laser scanning microscope images of the SPEEK membrane with positively charged fluorescent dye (a) and negatively charged fluorescent dye (b). Only the positively charged dyes can pass the membrane easily.

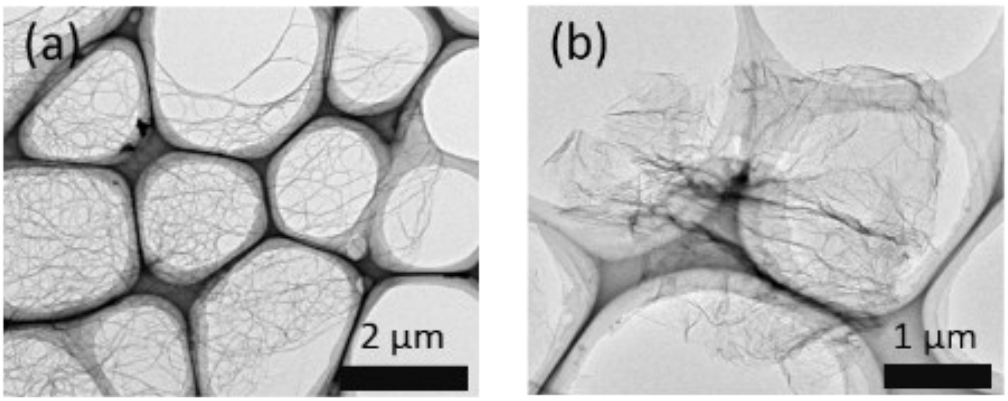

Fig. S3. TEM images of SWCNT (a) and rGO (b).

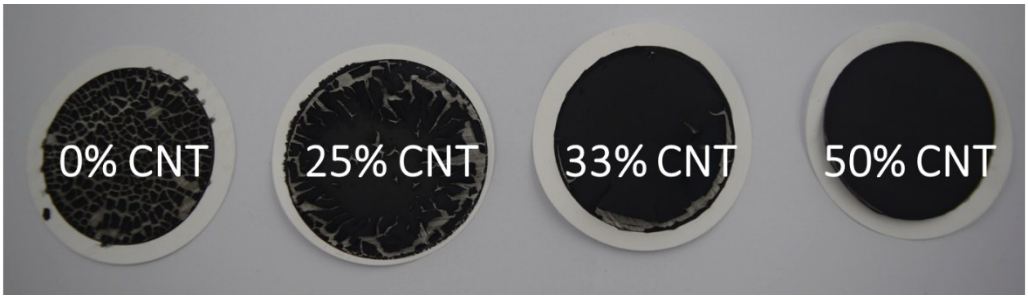

Fig. S4. Digital photos of SWCNT/rGO with different content of SWCNT on PVDF filtration paper.

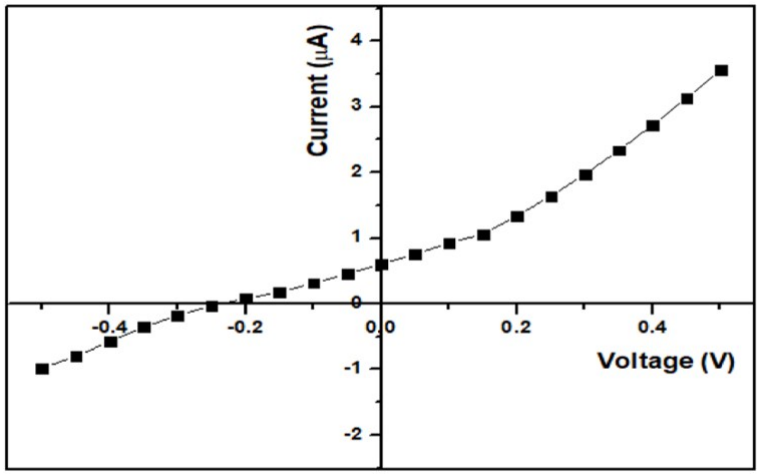

Fig. S5. I-V curve of the SPEEK membrane set in an H-type glass cell .

Fig. S6. The experimental setup to examine the ionic transport property. the SPEEK membrane or the SWCNT/rGO interlayer is mounted between a two-compartment electrochemical cell made of polytetrafluoroethylene materials and the cells are filled with the battery electrolytes. The Ag/AgCl electrodes are used to apply a transmembrane potential and the ionic current through the membrane is measured by a Keithley 6487 picoammeter