

Supplementary Information

A High-Performance Lithiated Silicon-Sulfur Battery Enabled by Fluorinated

Ether Electrolytes

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Material characterizations

The morphology of samples was observed by scanning electron microscopy (SEM) conducted on a JOEL-6700 SEM instrument at an accelerating voltage of 10 kV, and transmission electron microscopy (TEM) on a JEOL-2010 TEM instrument at 200 kV equipped with energy-dispersive X-ray spectroscopy (EDS). Thermogravimetric analysis (TGA) was measured with a TGA Q5000 (TA) instrument in a temperature range between 25-500 °C in N₂ with a heating rate of 2 °C min⁻¹. X-ray photoelectron spectroscopy (XPS) was conducted on a Physical Electronics PHI 5600 multi-technique system using an Al monochromatic X-ray source at 350 W. The time-of-flight secondary-ion mass spectrometry (ToF-SIMS) was carried out on a TOF SIMS V (ION-TOF GmbH) instrument equipped with a bismuth liquid-metal ion source for analysis and a Cs⁺ ion beam for sputtering.

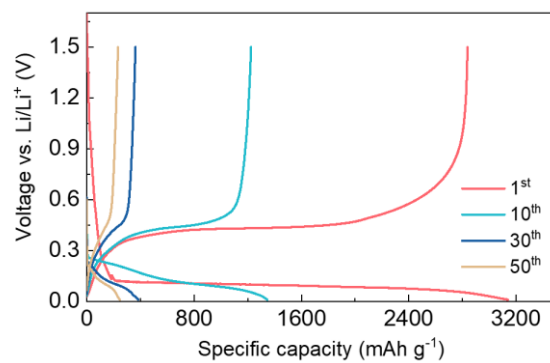


Fig. S1. Representative voltage profiles of SiMP electrodes using DME/DOL.

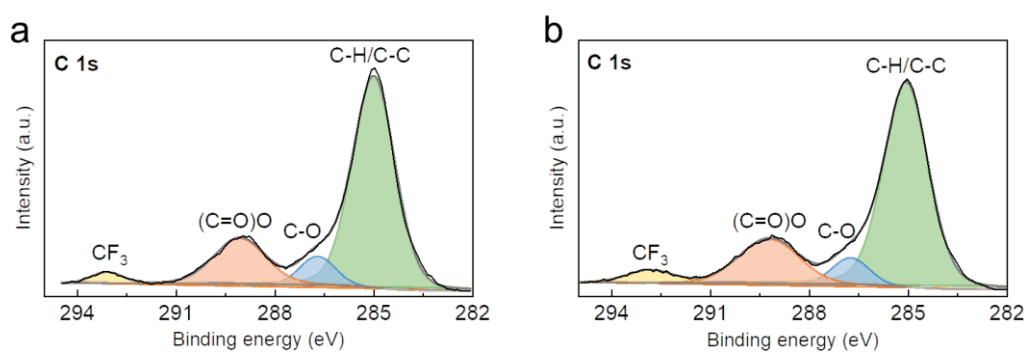


Fig. S2. C 1s spectra of SiMP electrode surface in (a) DME/DOL and (b) HFE/DOL.

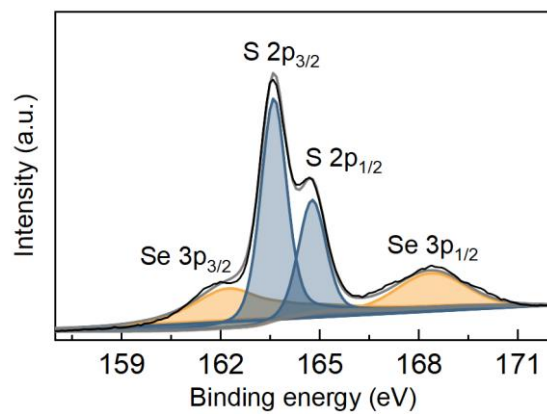


Fig. S3. S 2p and Se 3p spectra of Se/S@HCS composite.

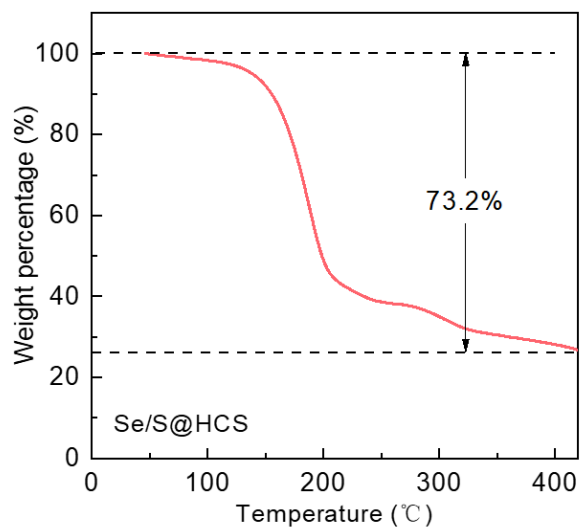


Fig. S4. TGA curve of Se/S@HCS composite.

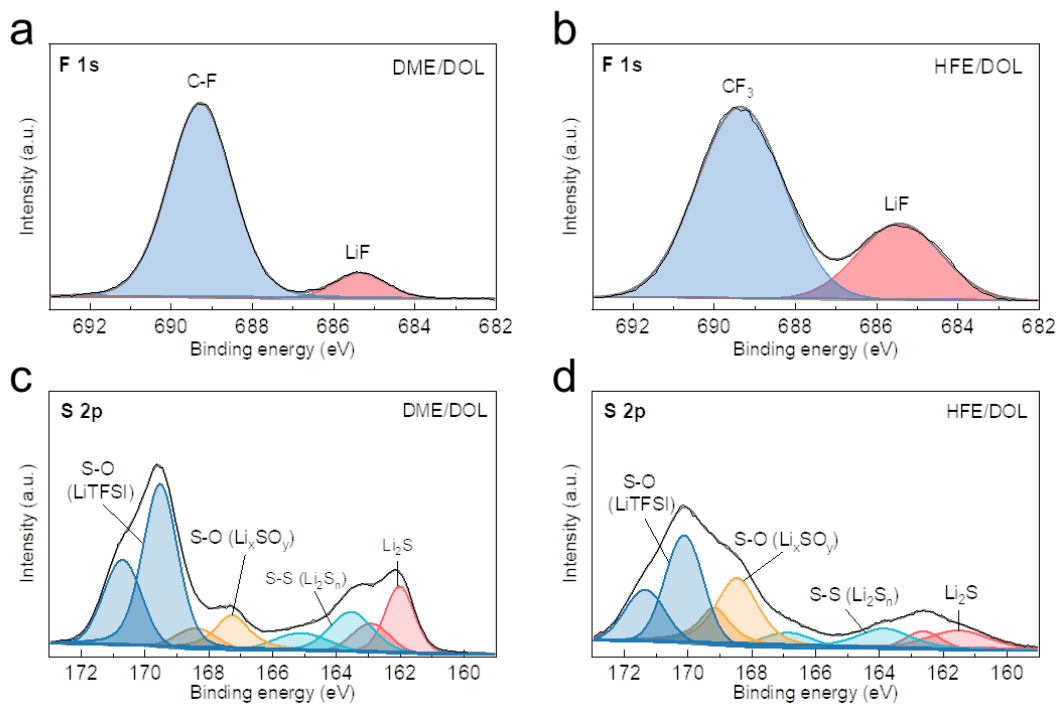


Fig. S5. F 1s spectra of cycled Se/S cathode using (a) DME/DOL and (b) HFE/DOL. S 2p spectra of (c) DME/DOL and (d) HFE/DOL.

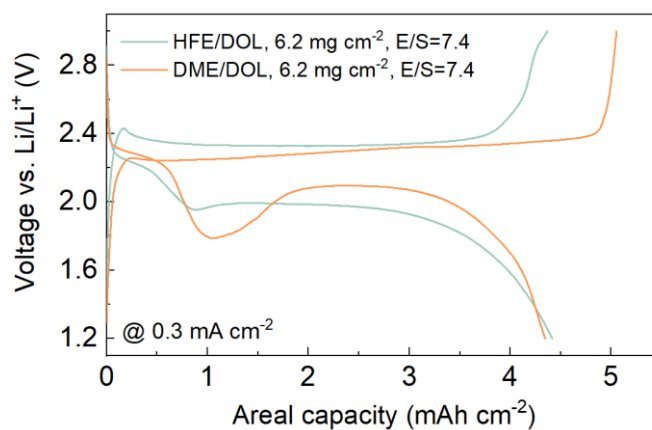


Fig. S6. Initial voltage profiles of Li-Se/S@HCS half cell at 0.3 mA cm⁻² under high loading and lean electrolyte conditions.

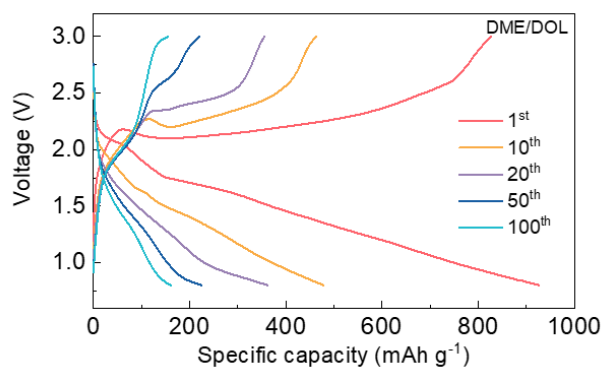


Fig. S7. Representative voltage profiles of lithiated SiMP-Se/S full cell using DME/DOL.