

Supporting information

**Ionic Liquid Electrolytes for Enhancing the Performance of
Lithium-Sulfur Batteries: A New Approach to Mitigating
Polysulfide Dissolution and Shuttle Effects**

Ajit Kumar^a, Frederick Nti^a, Jenny Sun^a, Mahin Maleki^a, Steve Rowlands^b, Paul M Bayley,^b Maria Forsyth^{a,*}, Patrick Howlett^{a*}

^aInstitute for Frontier Materials(IFM), Deakin University, Burwood, VIC 3125, Australia,

^bLi-S Energy, Deakin University, 75 Pigdons Rd, Waurn Ponds, Victoria 3216, Australia

E-mail: ajit.kumar@deakin.edu.au, maria.forsyth@deakin.edu.au, patrick.howlett@deakin.edu.au

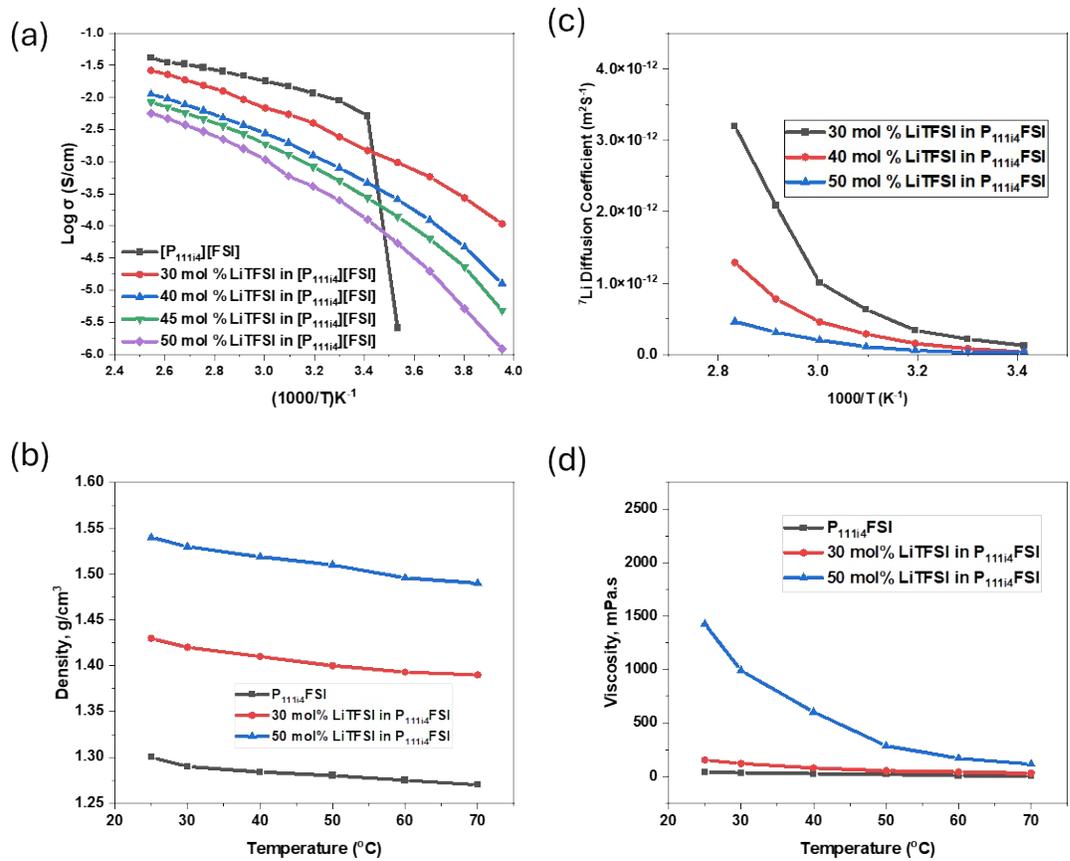


Figure S1. Characterization of P₁₁₁₁₄FSI/LiTFSI mixed anions electrolyte system at various compositions showing temperature dependent (a) ionic conductivity, (b) Density, (c) Diffusion coefficient, and (d) Viscosity.

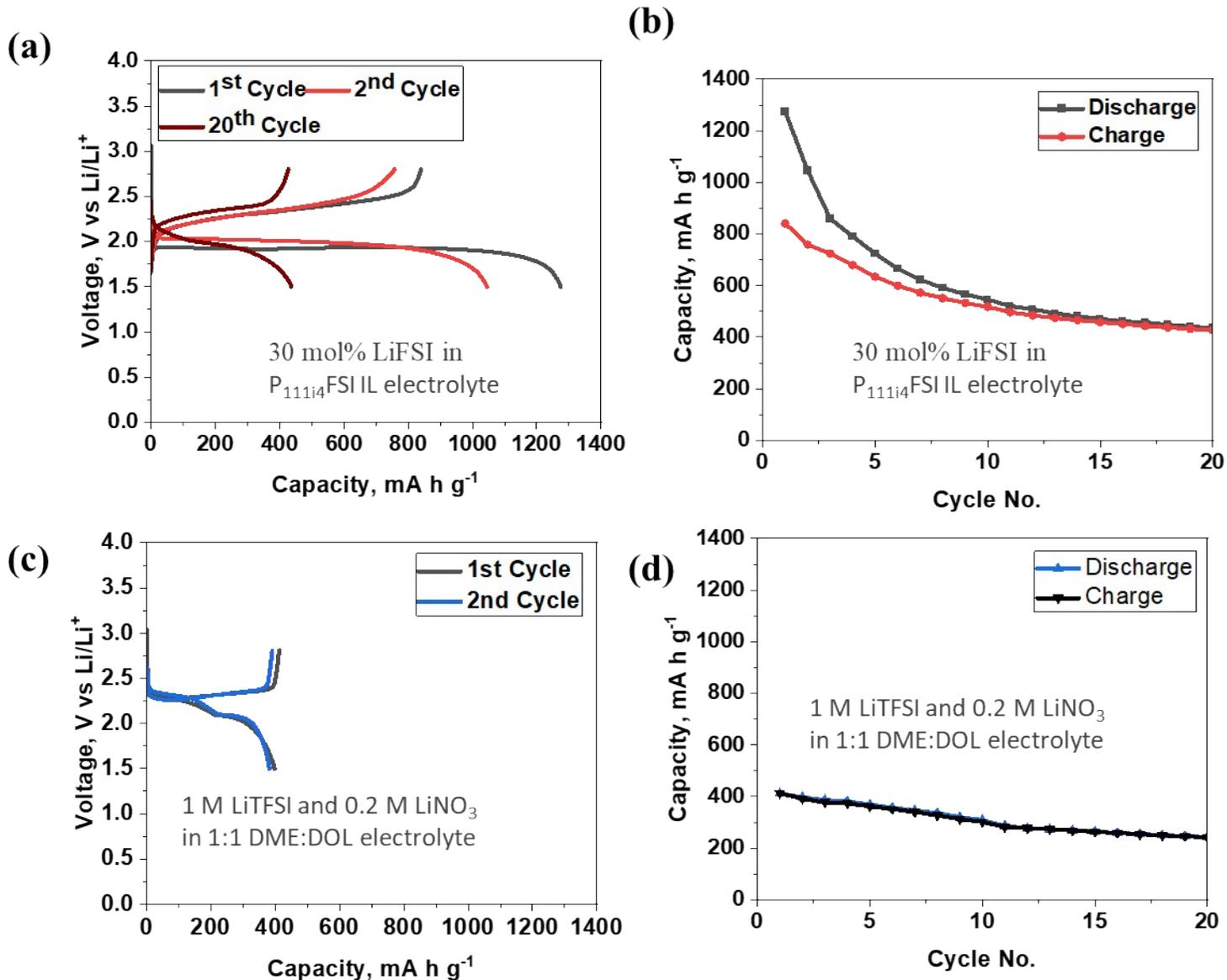


Figure. S2. Voltage vs capacity profile (a) and Capacity vs cycle number (b) of LiS cell (15 wt % CMC, 21 wt % HSAC, 14 wt % C65, and 50 wt % S) in 30 mol% LiFSI in P₁₁₁₁₄FSI FSI IL electrolyte at C/10 at 50 °C. Voltage vs capacity profile (c) and Capacity vs cycle number (d) of LiS cell (15 wt % CMC, 21 wt % HSAC, 14 wt % C65 and 50 wt % S) in 1 M LiTFSI and 0.2 M LiNO₃ in 1:1 DME:DOL electrolyte at C/10 at 50 °C.

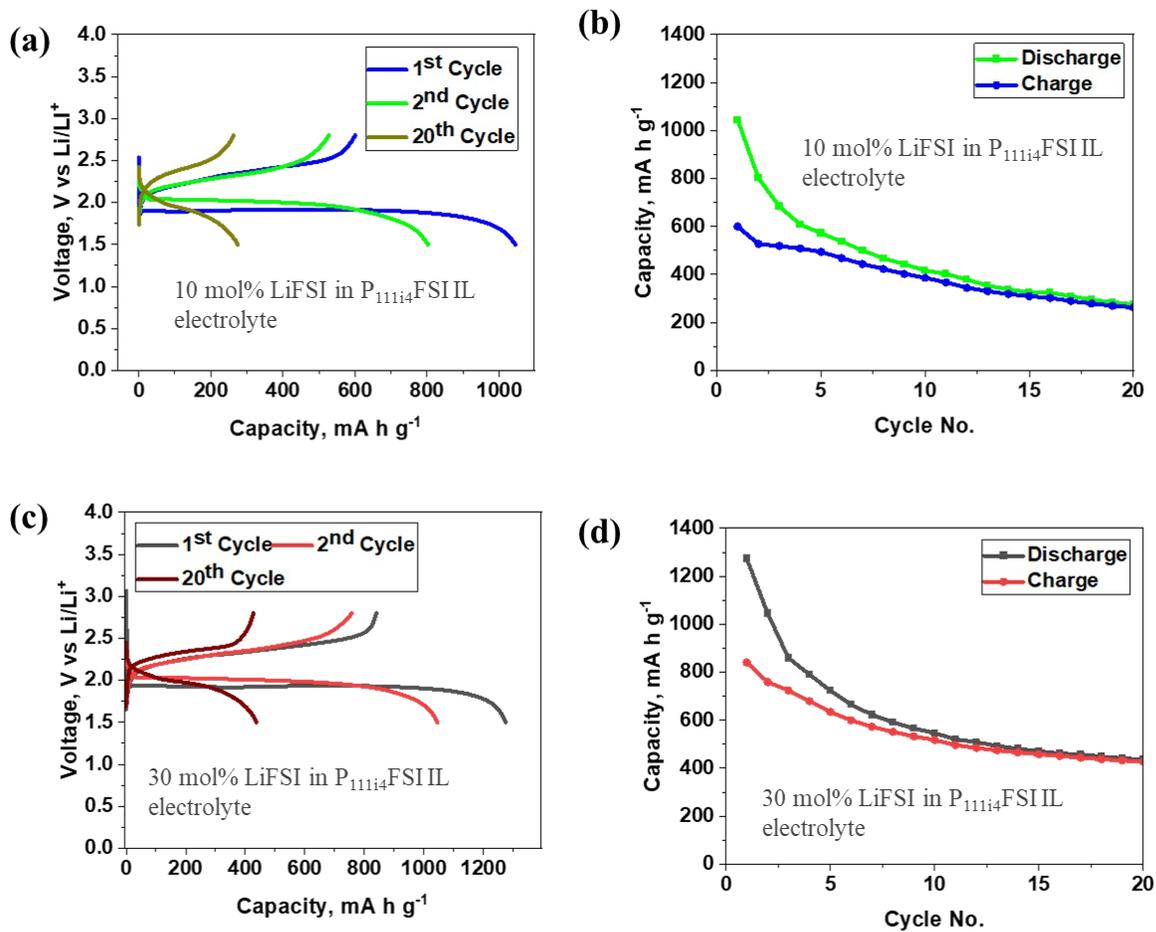


Figure. S3. Voltage vs capacity profile (a) and Capacity vs cycle number (b) of LiS cell (15 wt % CMC , 21 wt % HSAC, 14 wt % C65 and 50 wt % S) in 10 mol% LiFSI in P_{111i4}FSI IL electrolyte at C/10 at 50 C. Voltage vs capacity profile (c) and Capacity vs cycle number (d) of LiS cell in 30 mol% LiFSI in P_{111i4}FSI FSI IL electrolyte at C/10 at 50 C.

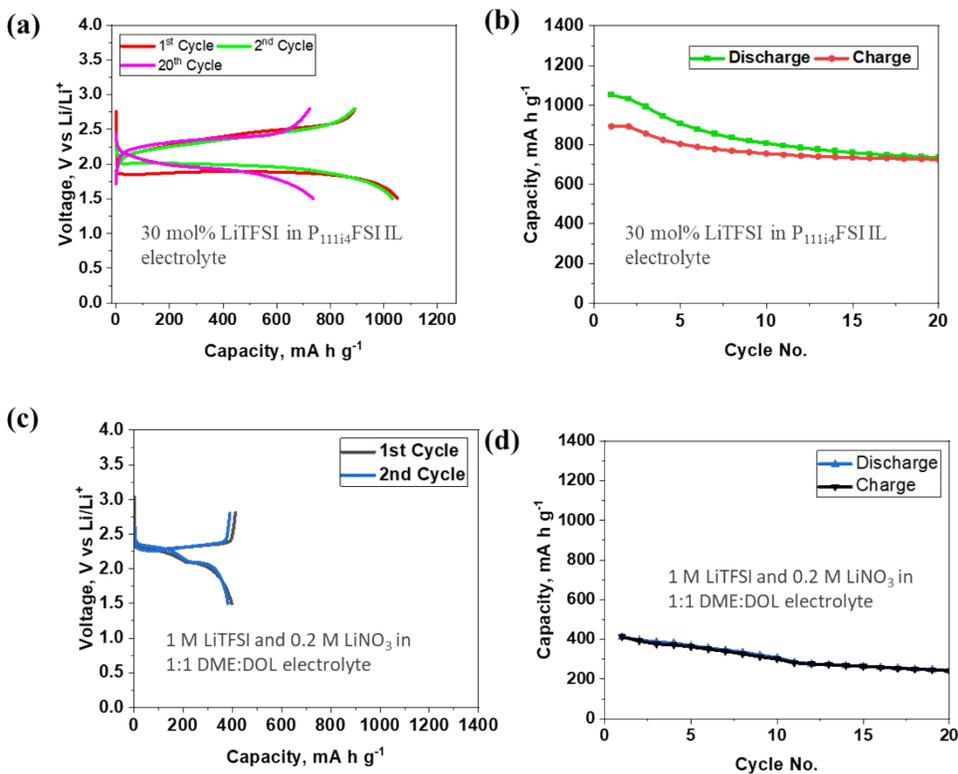


Figure. S4. Voltage vs capacity profile (a) and Capacity vs cycle number (b) of LiS cell (15 wt % CMC , 21 wt % HSAC, 14 wt % C65 and 50 wt % S) in 30 mol% LiTFSI in P₁₁₁₁₄FSI FSI IL electrolyte at C/10 at 50 C. Voltage vs capacity profile (c) and Capacity vs cycle number (d) of LiS cell in 1 M LiTFSI and 0.2 M LiNO₃ in 1:1 DME:DOL electrolyte at C/10 at 50 C.

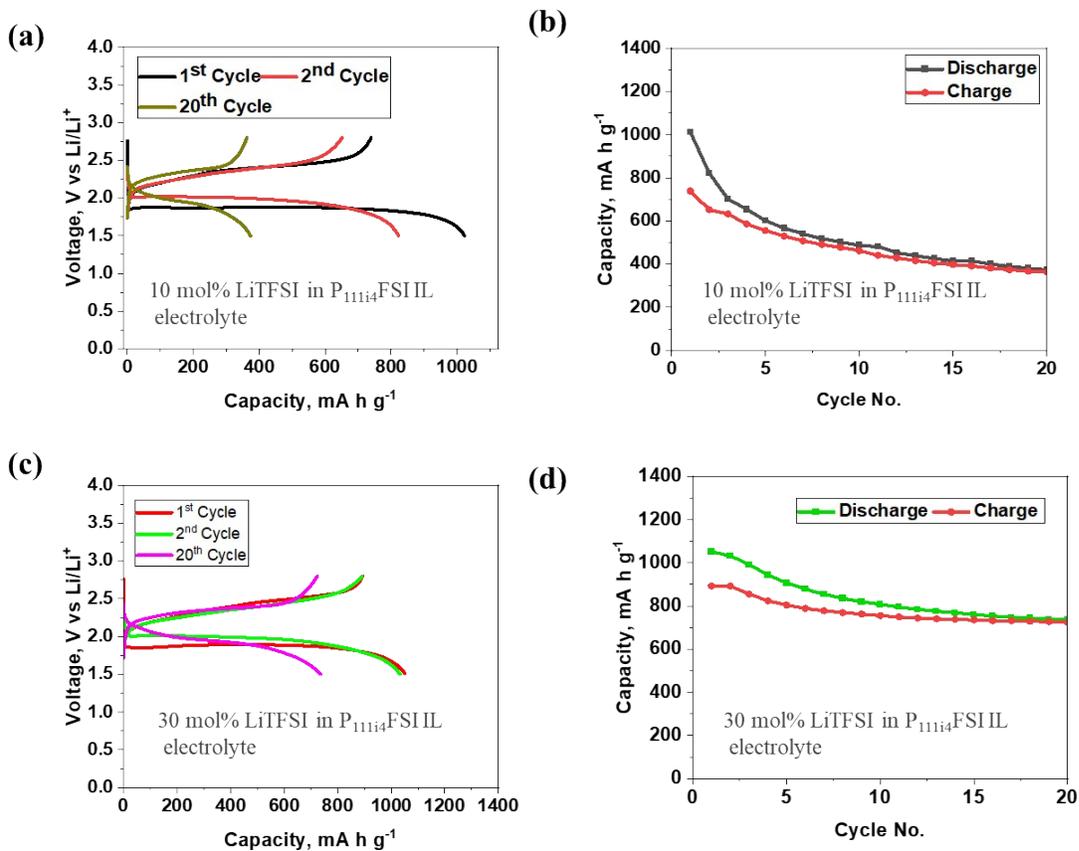


Figure. S5. Voltage vs capacity profile (a) and Capacity vs cycle number (b) of LiS cell (15 wt % CMC , 21 wt % HSAC, 14 wt % C65 and 50 wt % S) in 10 mol% LiTFSI in P_{111i4}FSI IL electrolyte at C/10 at 50 C. Voltage vs capacity profile (c) and Capacity vs cycle number (d) of LiS cell in 30 mol% LiTFSI in P_{111i4}FSI FSI IL electrolyte at C/10 at 50 C.

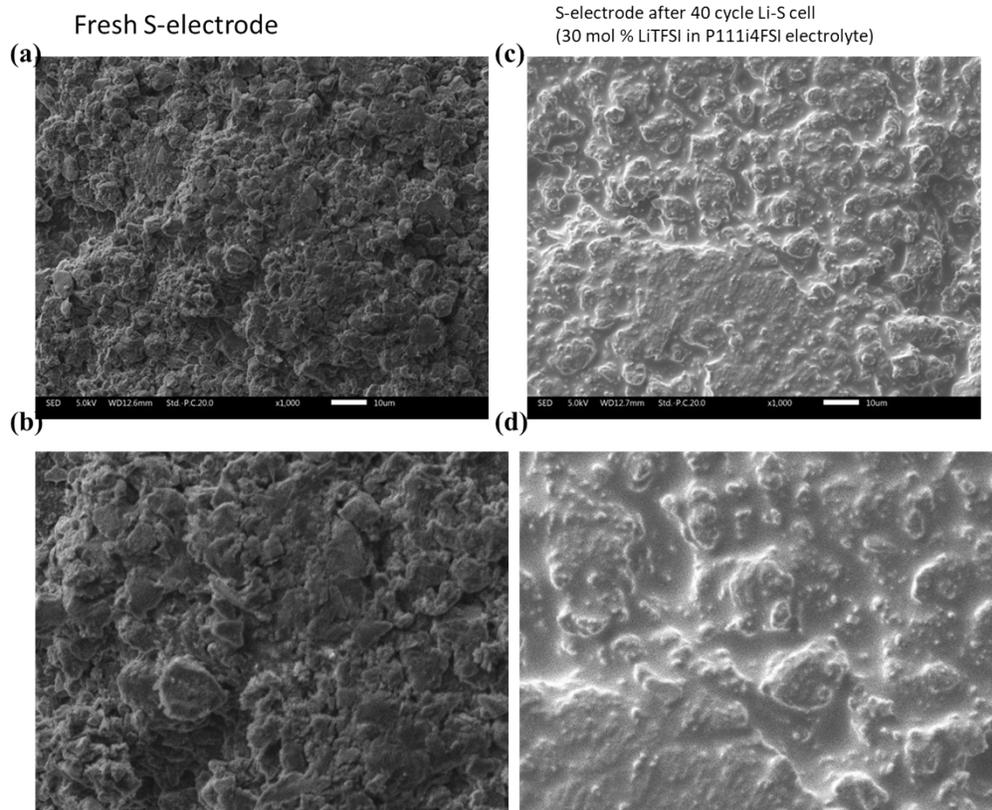


Figure S 6. SEM micrograph of S-electrode Pristine (a & b), after 40 cycle (c & d).