

Supporting Information:

Evaluation of glyoxal-based electrolytes for lithium-sulfur-batteries

Sebastian Kirchhoff^{1,2}, Christian Leibing^{3,4}, Paul Härtel¹, Thomas Abendroth¹, Susanne Dörfler¹, Holger Althues^{*,1}
Stefan Kaskel^{1,2} and Andrea Balducci^{3,4}

1. Stability tests against Lithium + Polysulfides

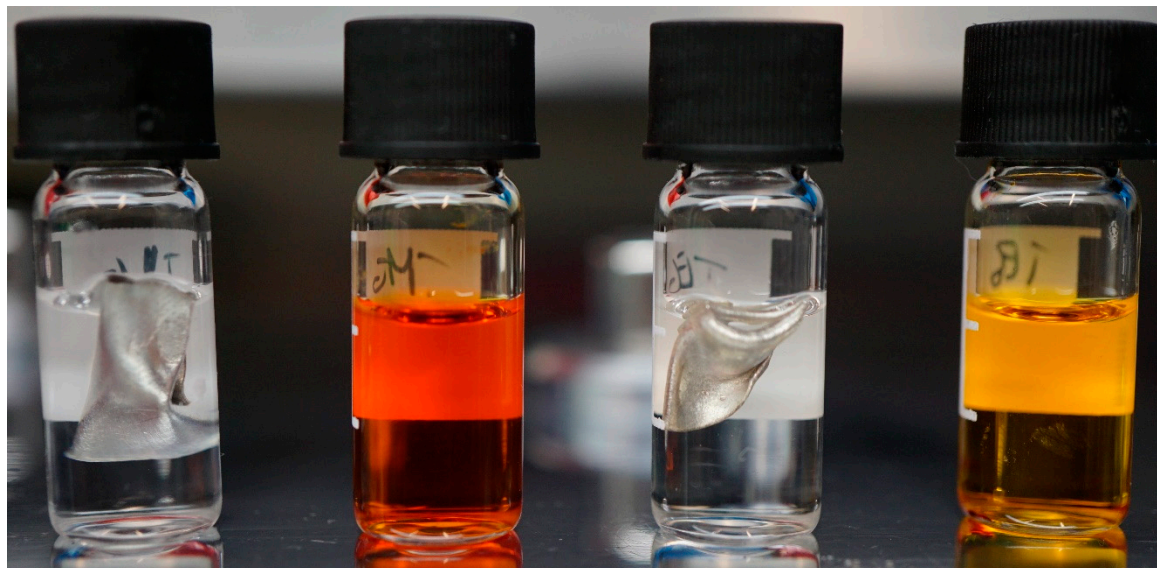


Figure S1. Stability tests of glyoxal-based solvents against lithium and polysulfides: TMG (left) and TEG (right).

2. Further voltage profiles of the developed electrolytes

2.1 Voltage profiles for adjusted TMG:DOL electrolytes with 1 M LiTFSI

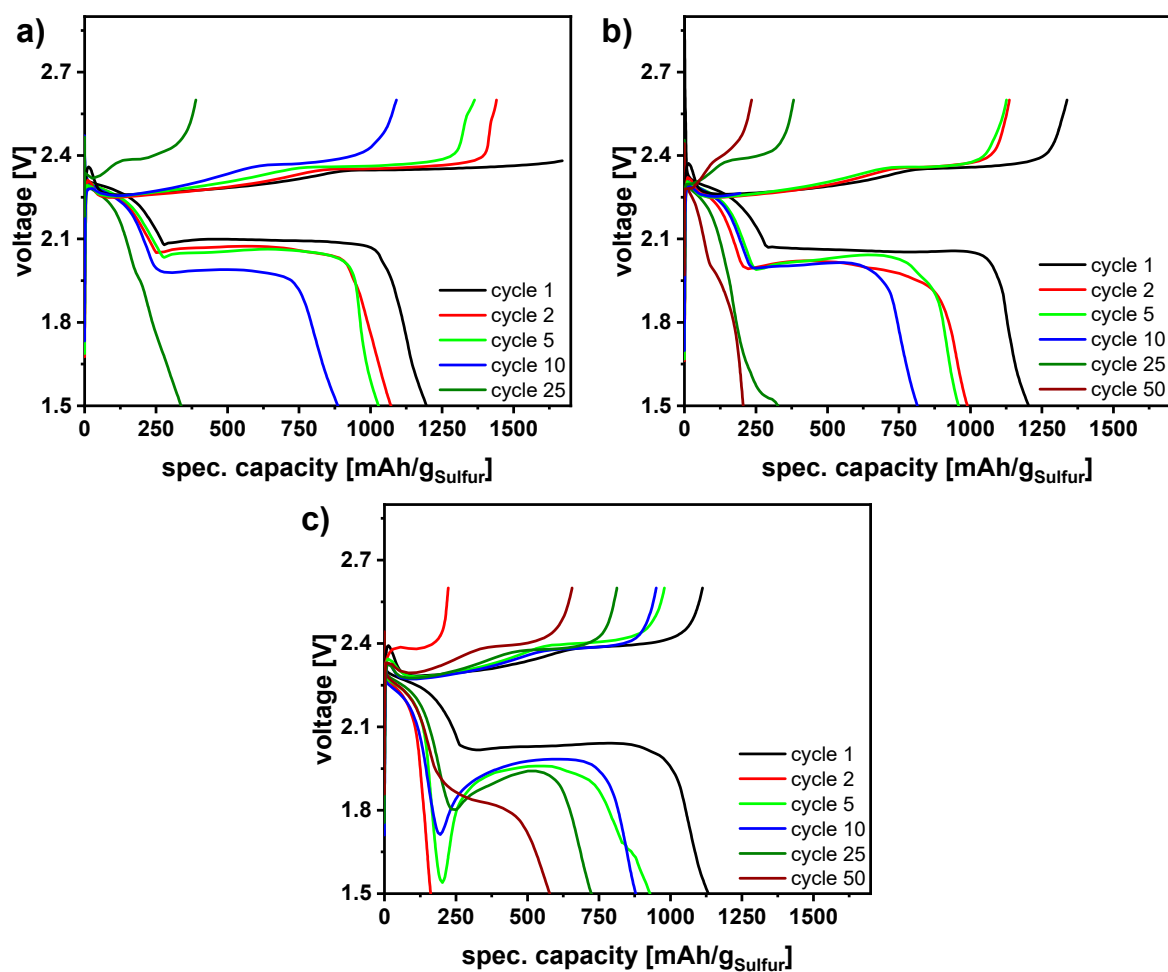


Figure S2. Voltage profiles of TMG:DOL electrolytes with 1 M LiTFSI: (a) TMG:DOL 1:1, (b) TMG:DOL 3:1, (c) TMG:DOL 9:1.

2.2 Influence of salt concentration

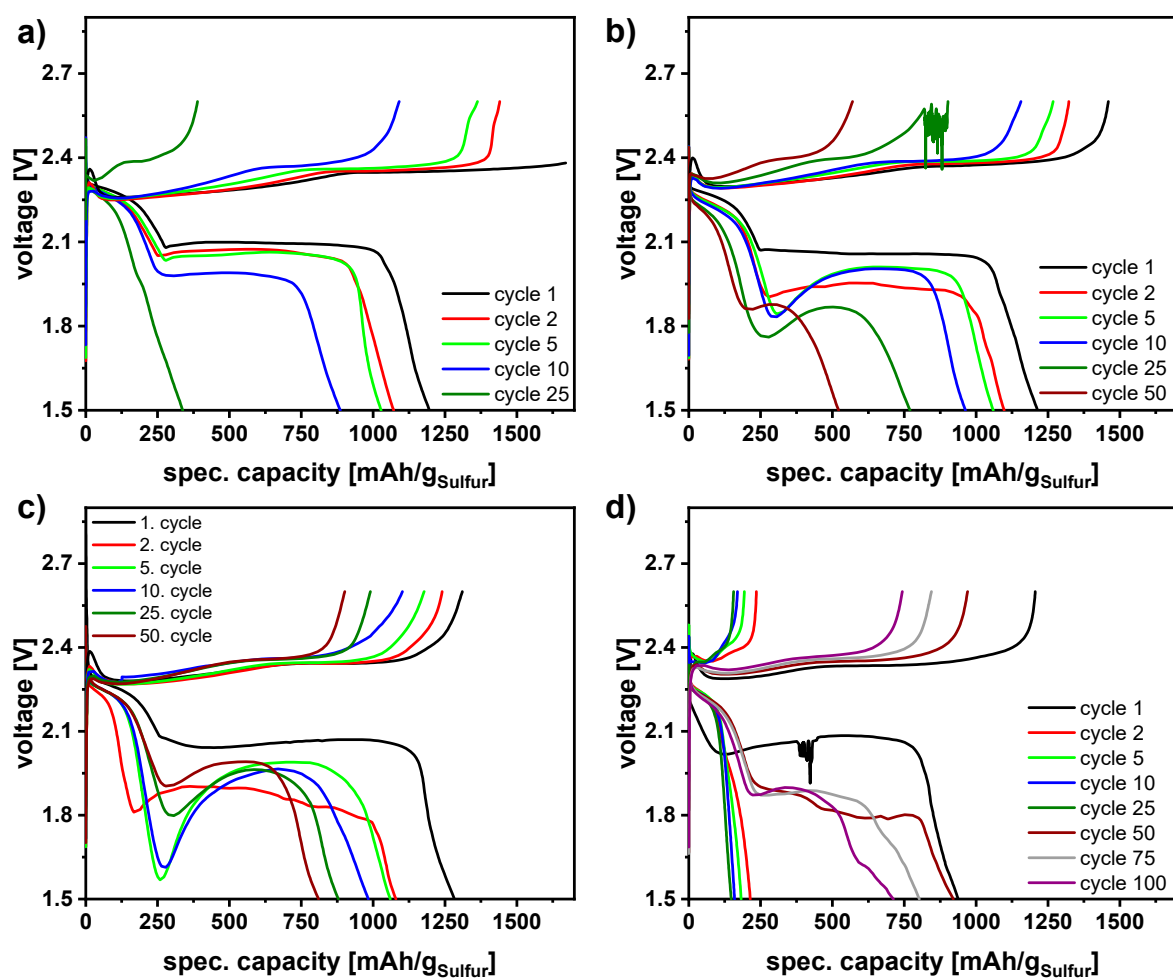


Figure S3. Voltage profiles of TMG:DOL 1:1 with varying LiTFSI concentration: (a) 1 M, (b) 1.5 M, (c) 2 M, (d) 3 M.

2.3 Voltage profiles of optimized glyoxal-based solvent blends with DOL + DOL-reference

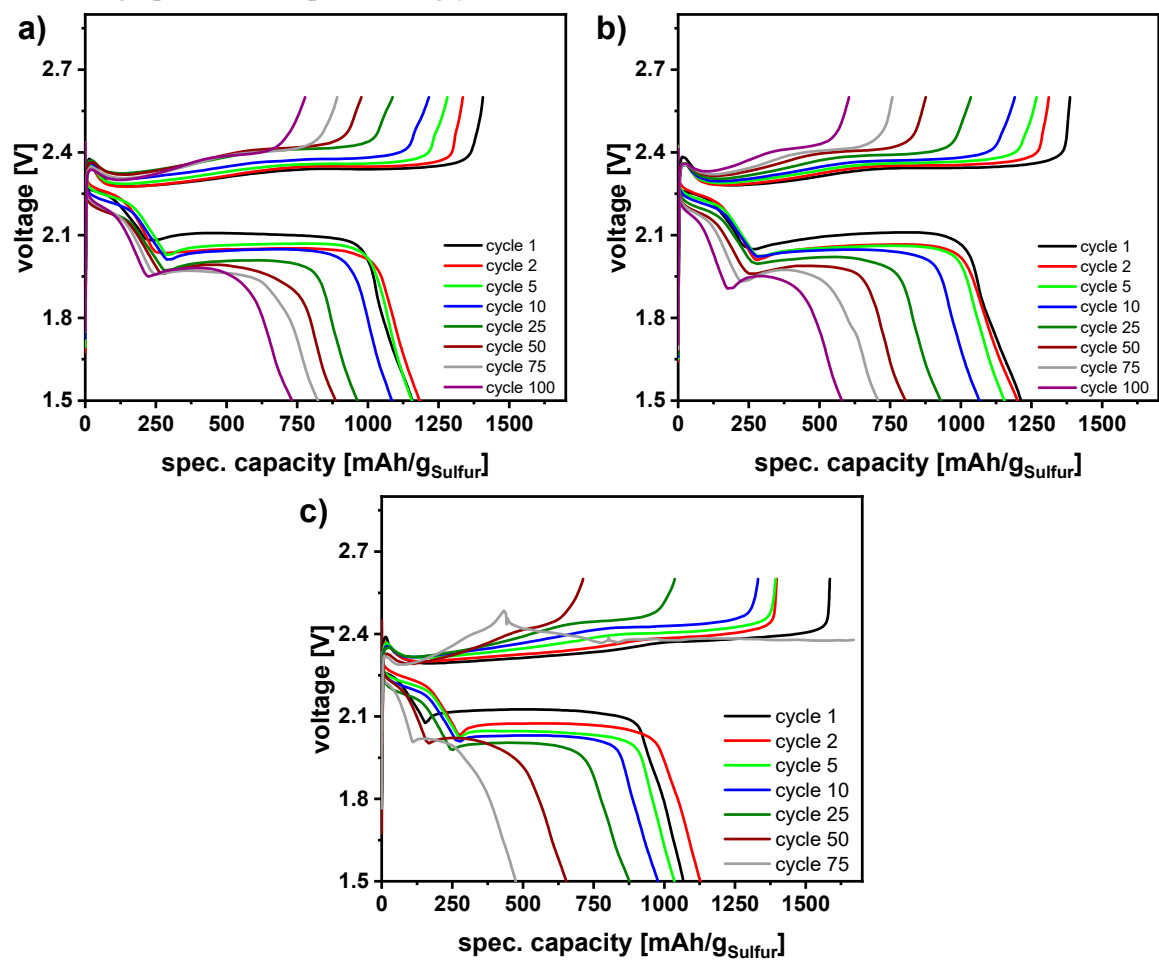


Figure S4. Voltage profiles of optimized electrolytes + reference: (a) TMG:DOL 1:3, 2 M LiTFSI, (b) TEG:DOL 1:3, 2 M LiTFSI, (c) DOL, 2 M LiTFSI.

3. Thermogravimetric Analysis

For the four solvent blends of glyoxal solvent and DOL with 2 M LiTFSI thermogravimetric analysis were performed, shown in Figure S5.

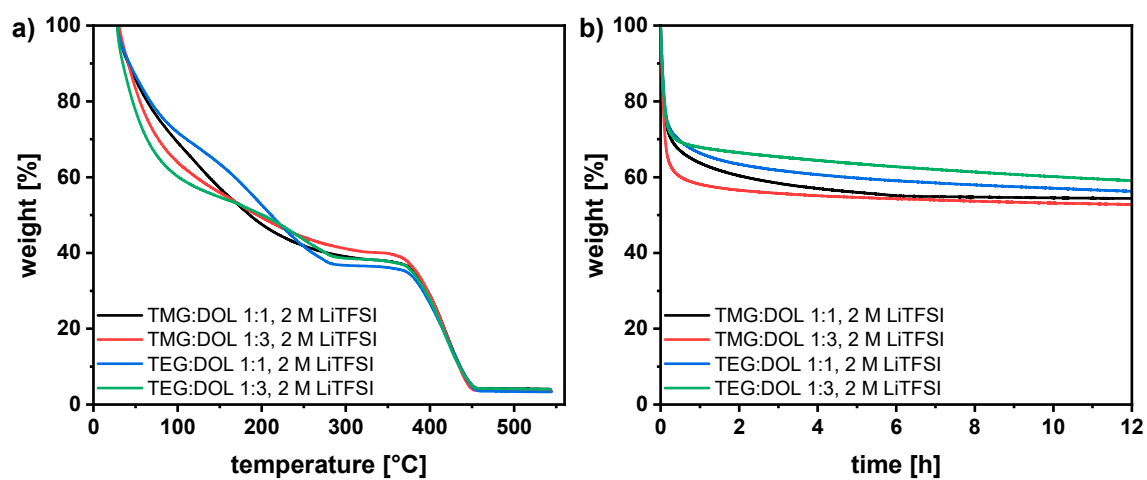


Figure S5. Thermogravimetric analysis of TXG:DOL solvent blends with 2 M LiTFSI: (a) Temperature ramp to 550 °C, (b) Isotherme at 60 °C.

4. Post Mortem Analysis of lithium-sulfur pouch cells

The pouch cells were disassembled after cycling and photos of the cell components were taken. In Figure S6 a representative picture of a lithium anode and a separator of each cell is shown.

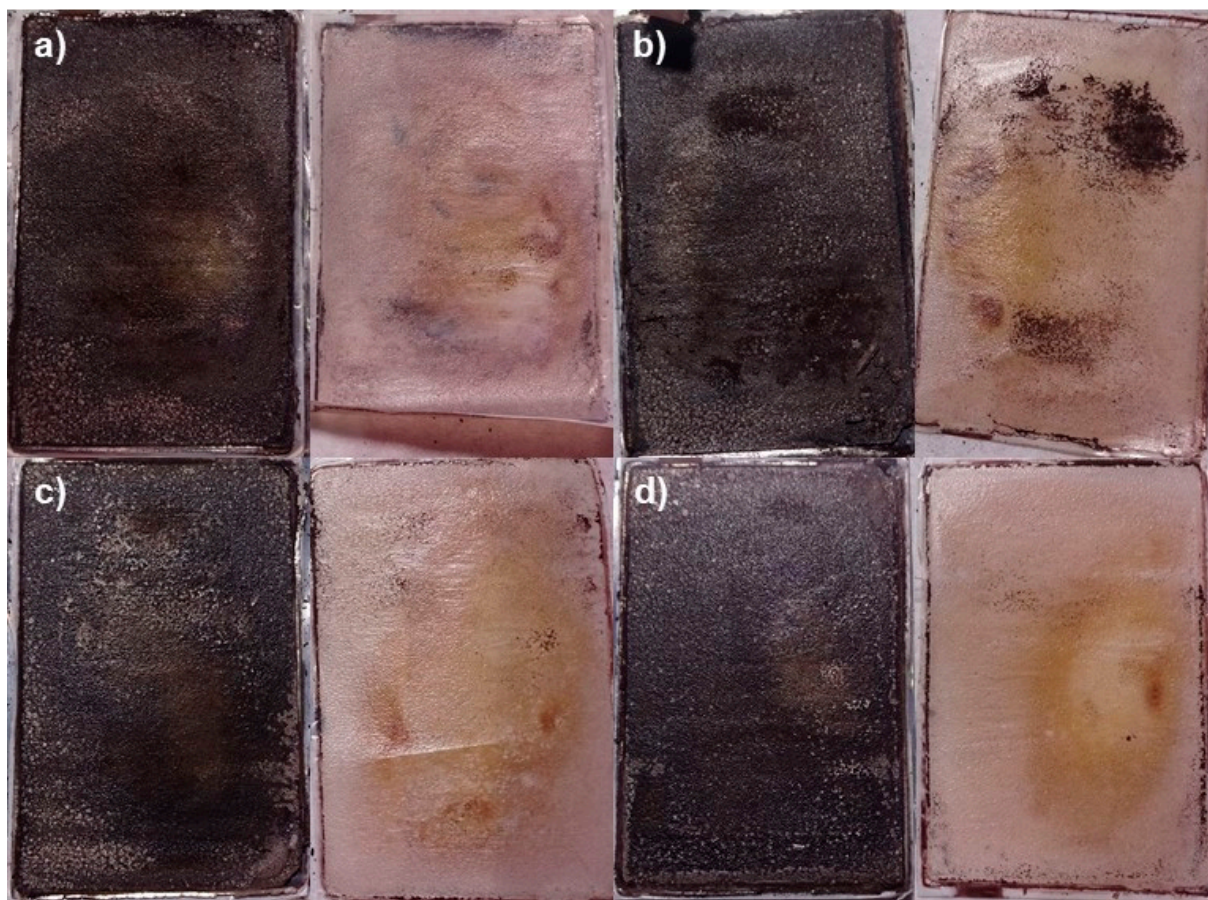


Figure S6. *Post Mortem* Analysis of lithium sulfur pouch cells: Lithium (left) and separator (right), (a,b) cell 1 and 2 with TMG:DOL 1:3, 2 M LiTFSI, (c,d) with TEG:DOL 1:3, 2 M LiTFSI.