Supporting Information

Quasi-Solid Polymer Electrolyte Initiated by Two-Dimensional Functional Nanosheets for Stable Lithium Metal Batteries

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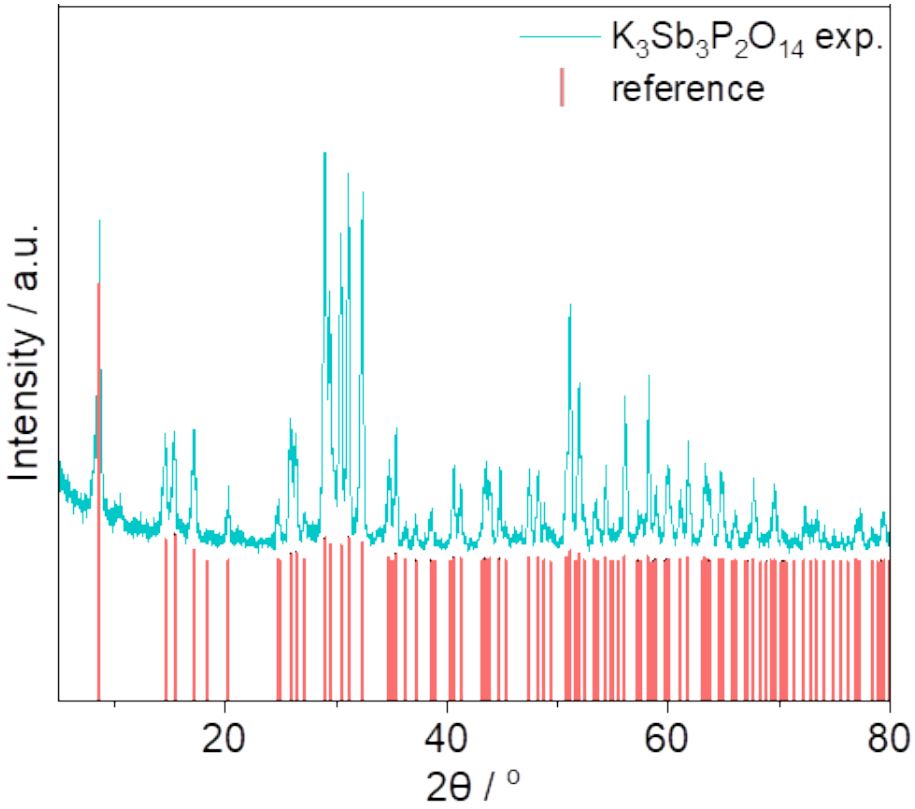


Fig. S1. X-ray powder diffraction (XRD) patterns of $K_3Sb_3P_2O_{14}$.

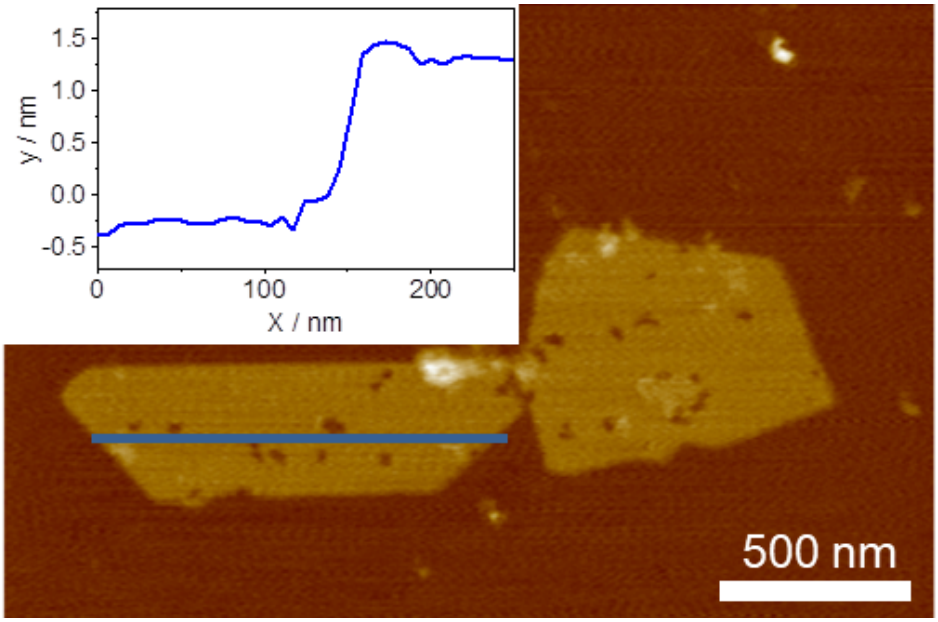


Fig. S2. AFM imaging of $Sb_3P_2O_{14}^{3-}$ nanosheets with a corresponding height profile (inset).

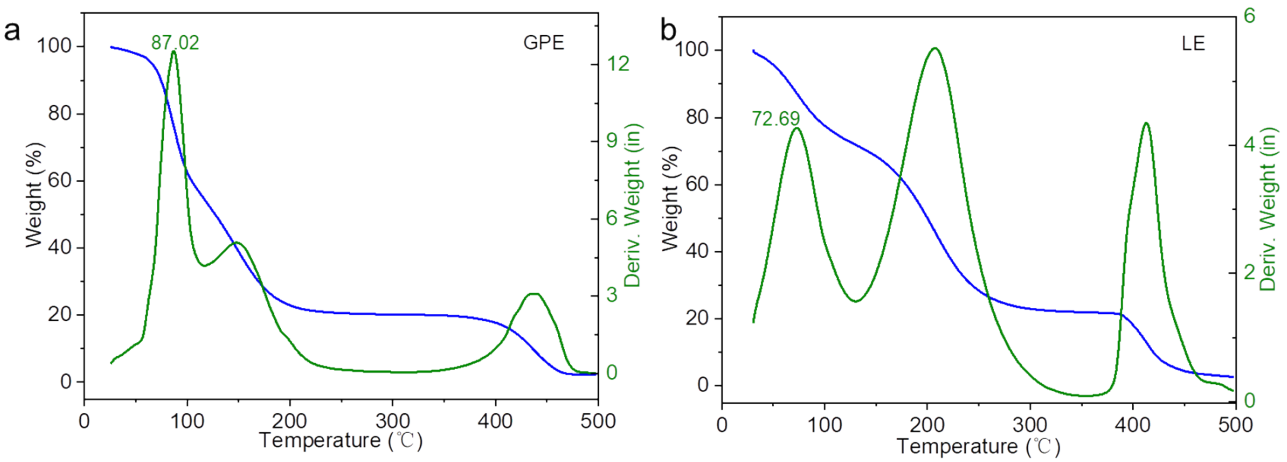


Fig. S3. The thermogravimetric curves of a) GPE and b) LE.

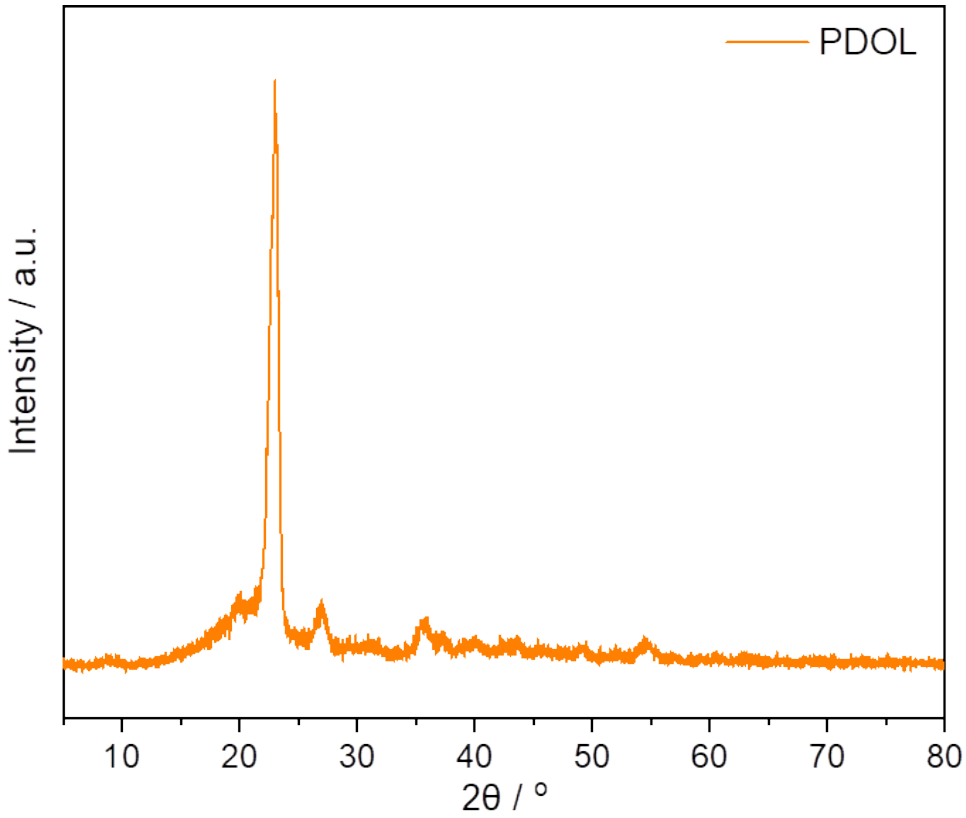
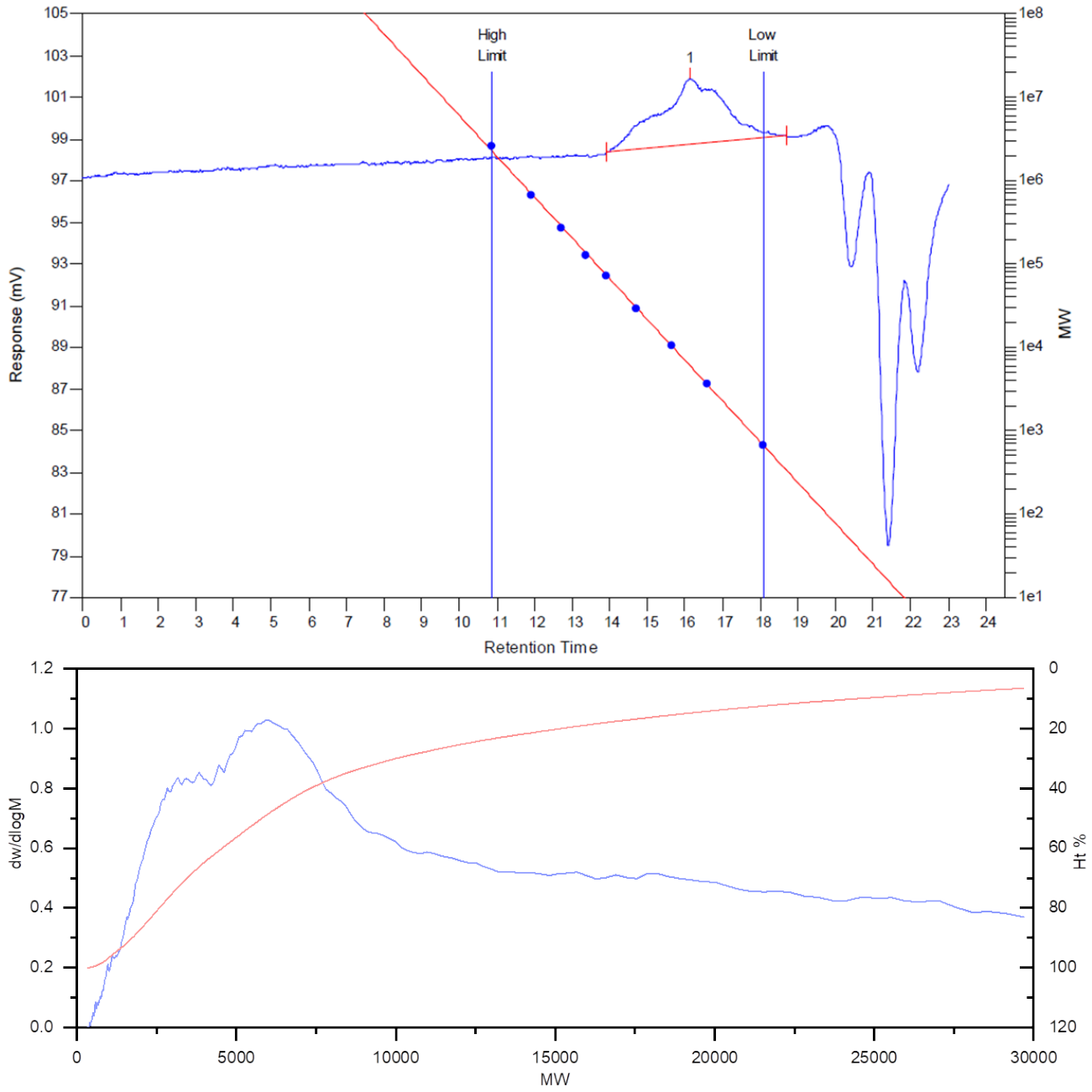


Fig. S4. X-ray powder diffraction (XRD) patterns of poly-DOL.



MW Averages

Peak No	Mp	Mn	Mw	Mz	Mz+1	Mv	PD
1	6011	3743	9601	20445	30783	8379	2.56505

Fig. S5. Gel Permeation Chromatography (GPC) of GPE.

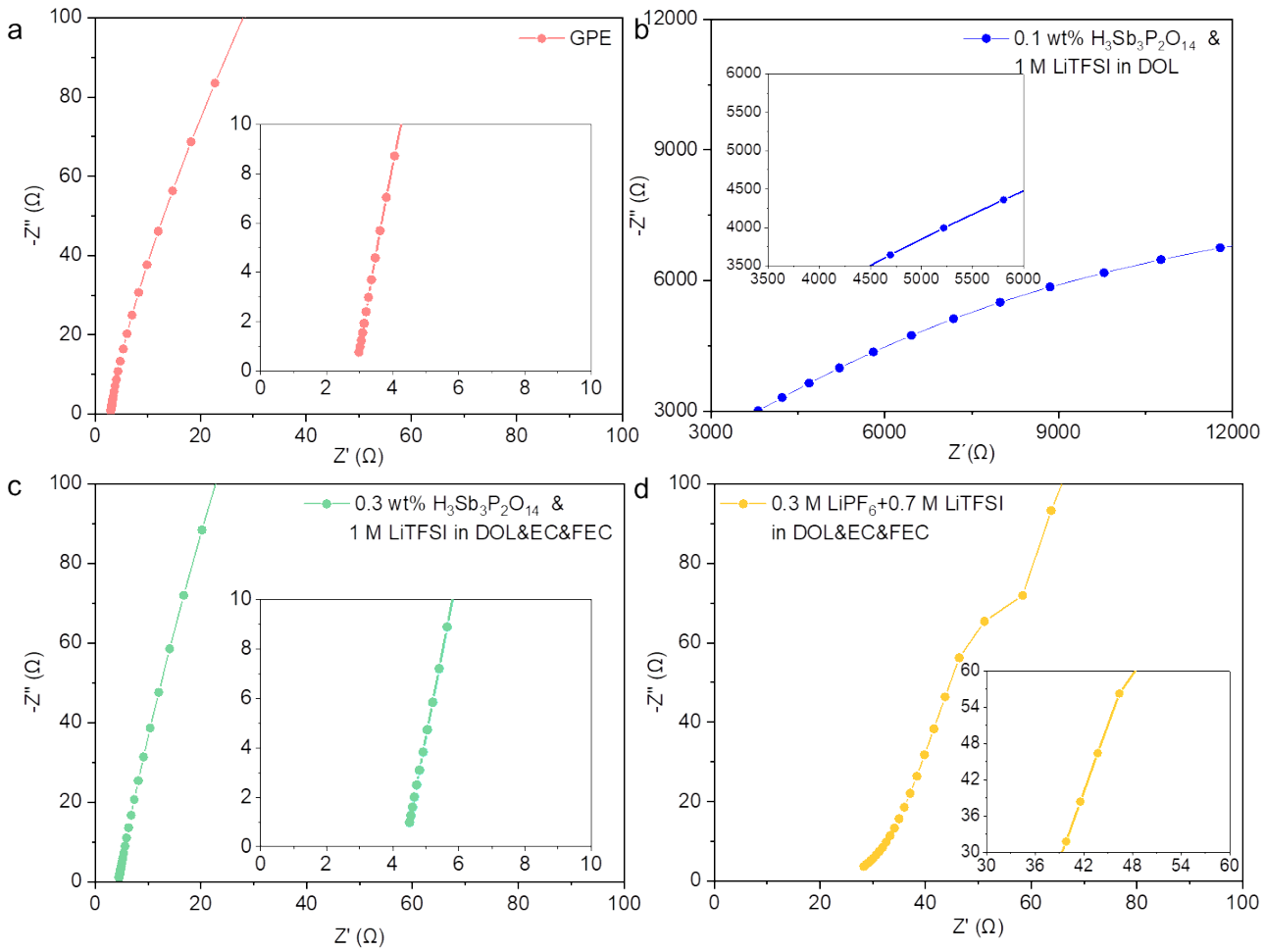


Fig. S6. The ionic conductivity of a) GPE; b) 0.1 wt% $H_3Sb_3P_2O_{14}$ &1 M LiTFSI in DOL; c) 0.3 wt% $H_3Sb_3P_2O_{14}$ &1 M LiTFSI in DOL&EC&FEC d) 0.3 M $LiPF_6$+0.7 M LiTFSI in DOL&EC&FEC.

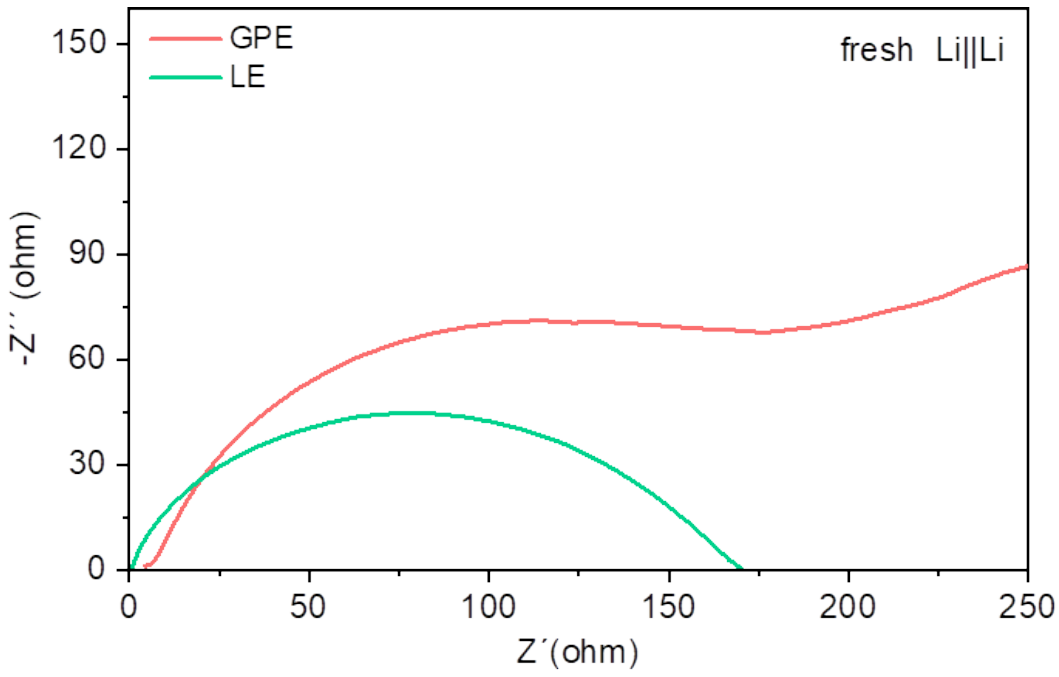


Fig. S7. Electrochemical impedance spectroscopy (EIS) curves of GPE-Li and LE-Li symmetric cells.

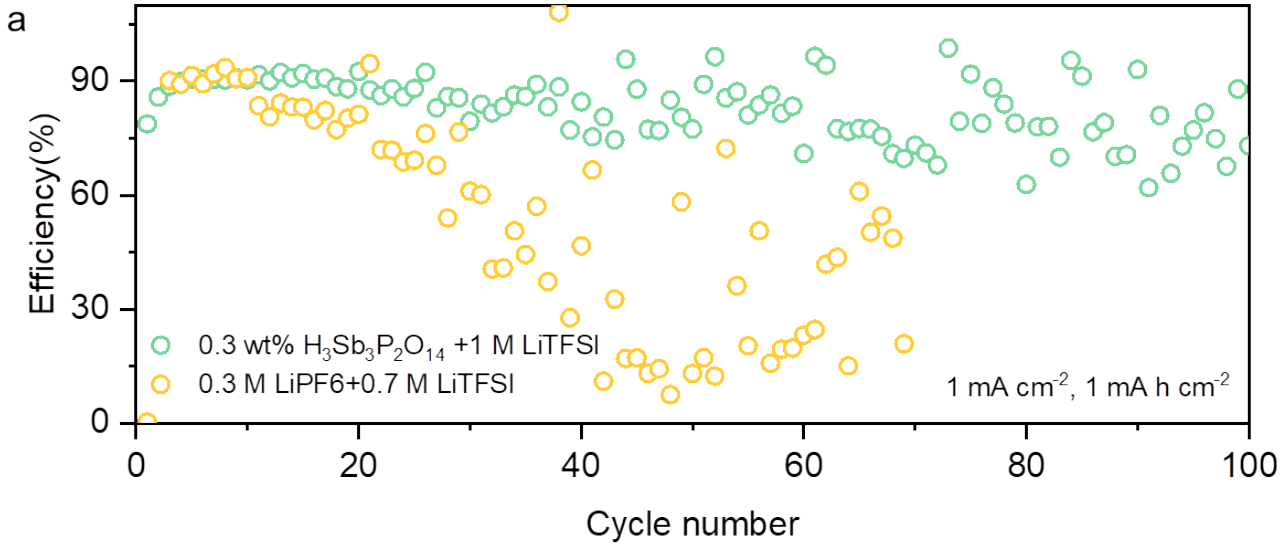


Fig. S8. CEs for the 0.3 M $LiPF_6$+0.7 M LiTFSI in DOL&EC&FEC and 0.3 wt% $H_3Sb_3P_2O_{14}$ &1 M LiTFSI in DOL&EC&FEC at a 1 mA cm^{-2} and 1 mA h cm^{-2}.

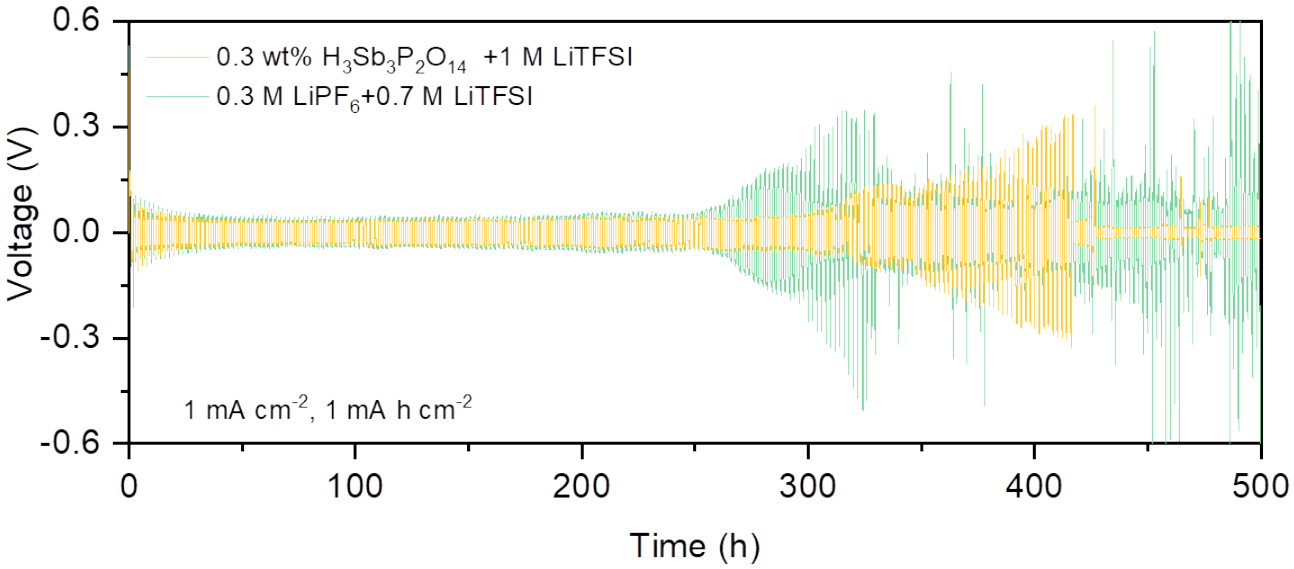


Fig. S9. Long-term cycling of symmetrical Li cells for the 0.3 M $LiPF_6$+0.7 M LiTFSI in DOL&EC&FEC and 0.3 wt% $H_3Sb_3P_2O_{14}$ &1 M LiTFSI in DOL&EC&FEC at a 1 mA cm^{-2} and 1 mA h cm^{-2}.

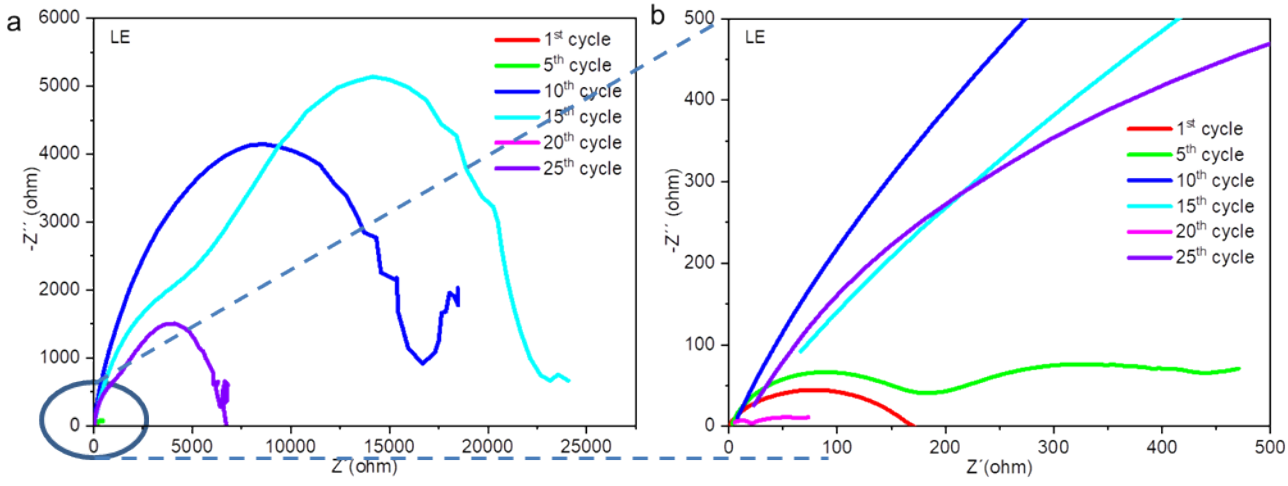


Fig. S10. a) Electrochemical impedance spectroscopy and b) corresponding magnified view for Li||LE||Li cell after different plating/stripping cycles.

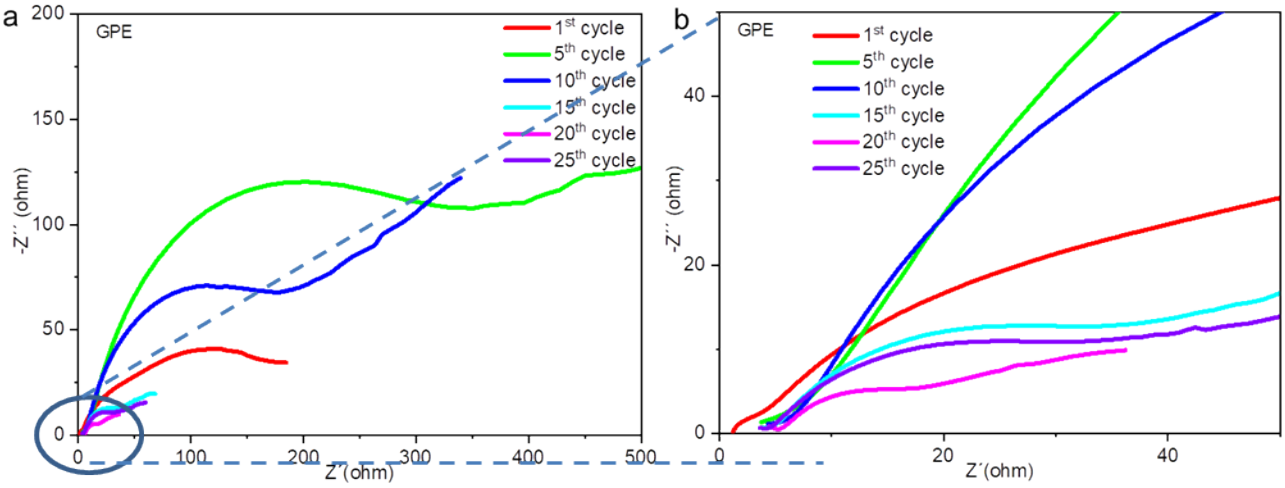


Fig. S11. a) Electrochemical impedance spectroscopy and b) corresponding magnified view for Li||GPE||Li cell after different plating/stripping cycles.

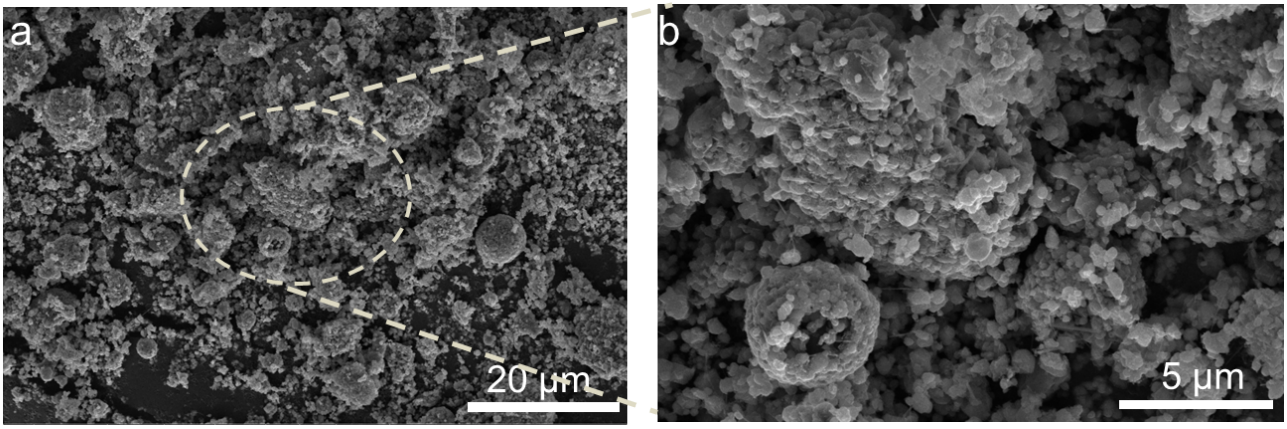


Fig. S12. a) SEM image and b) magnified SEM image of $LiFePO_4$ powder.

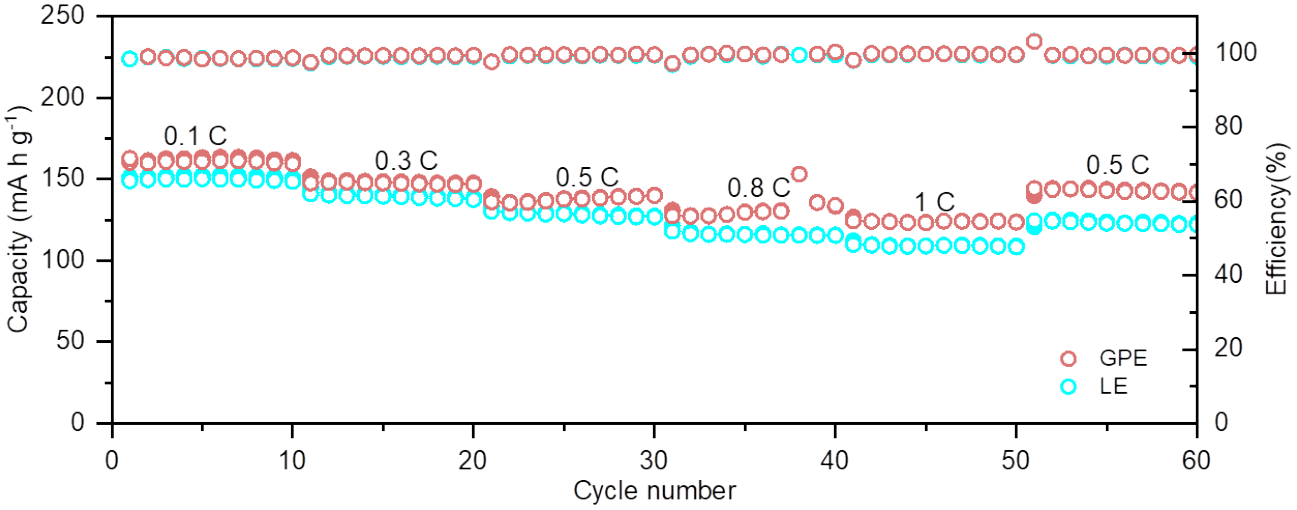


Fig. S13. The rate performance of Li||$LiFePO_4$ full cells.

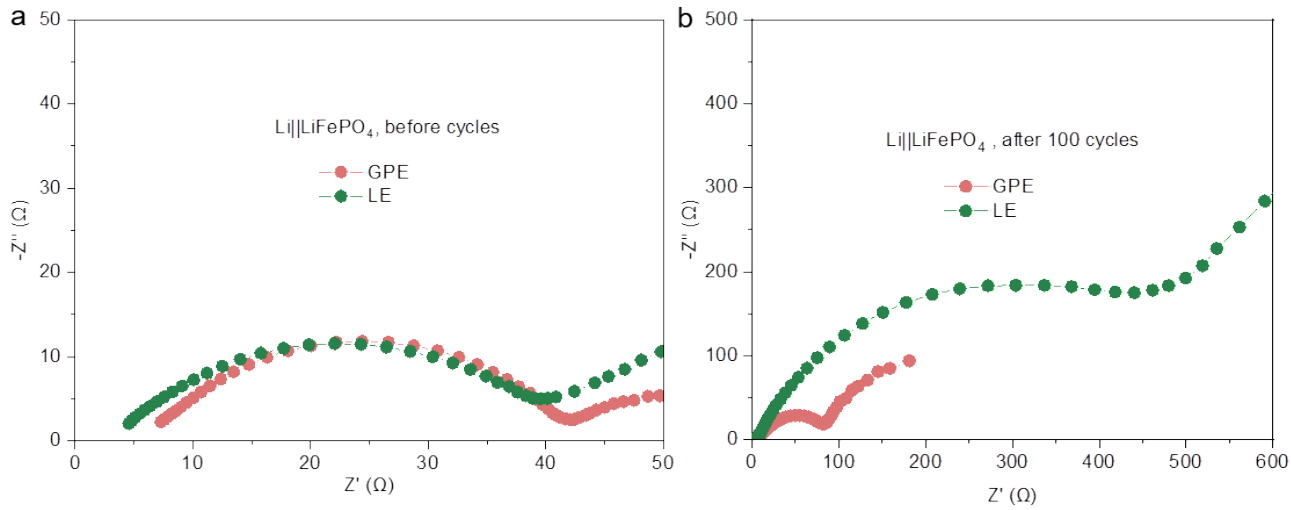


Fig. S14. Electrochemical impedance spectroscopy (EIS) of Li||$LiFePO_4$ full cells a) before and b) after 100 cycles at 1 C.

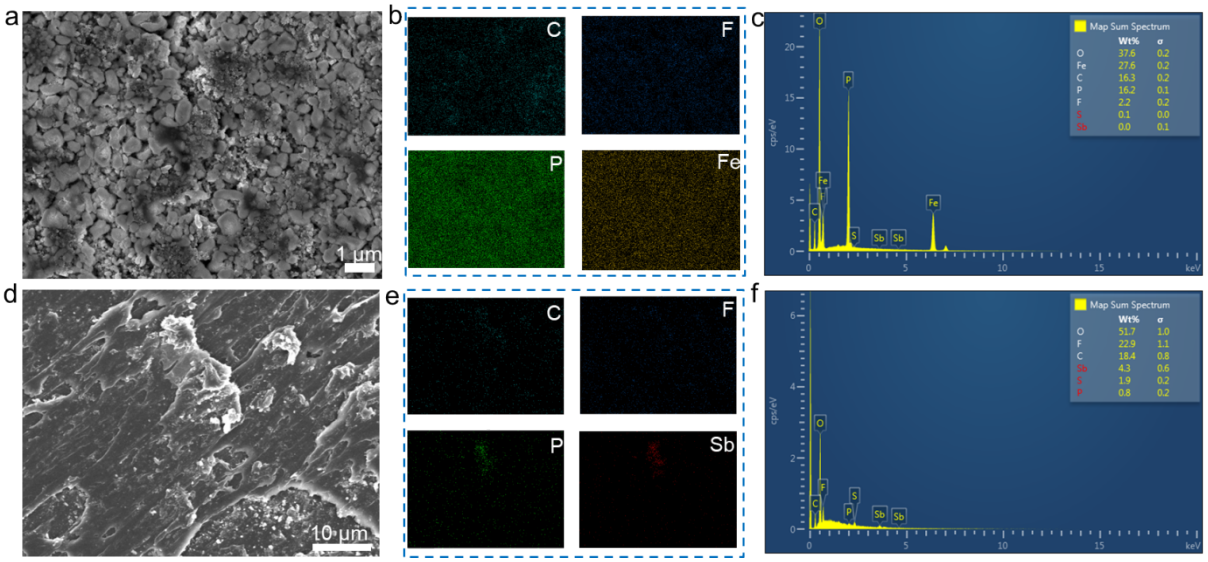


Fig. S15. The surface SEM images and corresponding mapping images for a-c) $LiFePO_4$ cathode and d-f) Li anode in the GPE system after 100 cycles at 1 C.

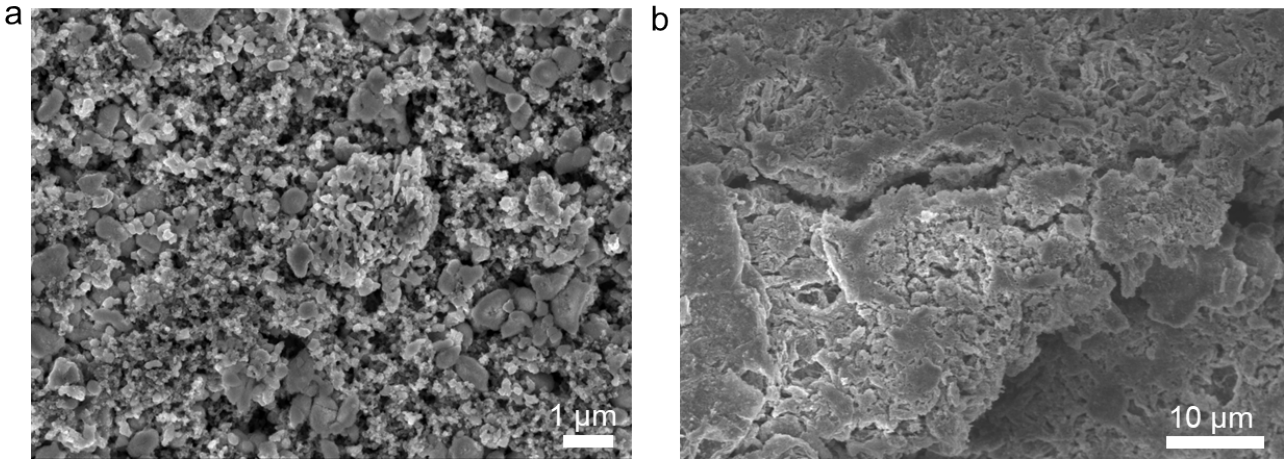


Fig. S16. The surface SEM images of a) $LiFePO_4$ cathode and b) Li anode in the LE system after 100 cycles at 1 C.

Table S1. The comparison of coulombic efficiency of various poly-DOL electrolytes.

Initiator	Electrolyte	Current density (mA cm^{-2})	Capacity (mAh cm^{-2})	Coulombic efficiency (%)	Cycle number	Reference
$LiPF_6$	2 M $LiPF_6$+ 1 M LiTFSI / PDOL +DME (1:1 , v/v)	1	1	～90	100	[1]
$LiPF_6$	1 M $LiPF_6$+EC/DOL/	1	～	/	100	[2]
$LiPF_6$	1 M LiTFSI+ $LiPF_6$ in DOL/FEC/MP	0.1	0.2	～94	200	[3]
TB	2 M LiTFSI+ 3wt%TB in DOL	0.5	0.5	～86.2	200	[4]
$Al(OTf)_3$	0.5 mM $Al(OTf)_3$ + 2 m LiTFSI/DOL	1	1	～98	300	[5]
$Sn(OTf)_2$	2 mM $Sn(OTf)_2$+2M in LiTFSI/DOL	1	1	～98	120	[6]
$H_3Sb_3P_2O_{14}$	**1 M LiTFSI+0.1wt% $H_3Sb_3P_2O_{14}$ in DOL/EC/FEC**	**0.5**	**0.5**	**～94.2**	**200**	**This work**
		1	**1**	**～94.3**	**100**	

Table S2. The performance comparison of various poly-DOL electrolytes in symmetric Li || Li cell.

Initiator	Electrolyte	Current density (mA cm^{-2})	Capacity (mAh cm^{-2})	Voltage hysteresis (mV)	Life (h)	Reference
$LiPF_6$	2 M $LiPF_6$+ 1 M LiTFSI + DOL + DME (1:1 , v/v)	1	1	～50	400	[1]
$LiPF_6$	2 M LiTFSI + 0.3 M LiDFOB/DOL+SN	0.5	0.5	～85	700	[7]
$LiPF_6$	1 M LiTFSI +$LiPF_6$(1 wt %) +DADS (1 wt %)/DOL	1	1	/	500	[8]
$LiPF_6$	1 M LiTFSI+1 M $LiPF_6$ in DME/DOL	0.5	1	～100	1200	[9]
$LiPF_6$	1 M LiTFSI+ $LiPF_6$ in DOL/FEC/MP	1	1	/	400	[3]
$LiPF_6$	2.5 M LiPF6 + 1 M LiTFSI in DOL	1	1	/	450	[10]
nano Al_2O_3	1 M LiTFSI+4%wt% Al_2O_3 in DME/DOL	1	1	～44	1000	[11]
$LiBF_4$	2.0 wt% TTE+1.0 M LiTFSI+ 0.2 M $LiBF_4$ in DOL	1	1	～70	1000	[12]
$ZnCl_2$	1.0 M LiTFSI in DOL and DME (1:1 v/v) + 5 wt% $LiNO_3$	1	1	/	660	[13]
$Al(OTf)_3$	0.5 mM $Al(OTf)_3$ + 2 m LiTFSI/DOL	1	1	/	200	[5]
$Al(OTf)_3$	0.4 mM $Al(OTf)_3$ + 2 m LiTFSI/DOL	0.25	0.5	/	800	[14]
$Sc(OTf)_3$	2 M LiTFSI + 7 mM $Sc(OTf)_3$ in DOL/EC/EMC	0.5	0.5	～47	500	[15]
$Sn(OTf)_2$	2 mM $Sn(OTf)_2$+2M in LiTFSI/DOL	1	1	/	200	[6]
$H_3Sb_3P_2O_{14}$	**1 M LiTFSI+0.1wt% $H_3Sb_3P_2O_{14}$ in DOL/EC/FEC**	**1**	**1**	**50**	**500**	**This work**

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