Supporting information

Lithium salts regulated dual-stabilized elastomeric quasi-solid electrolyte for high-voltage lithium metal battery

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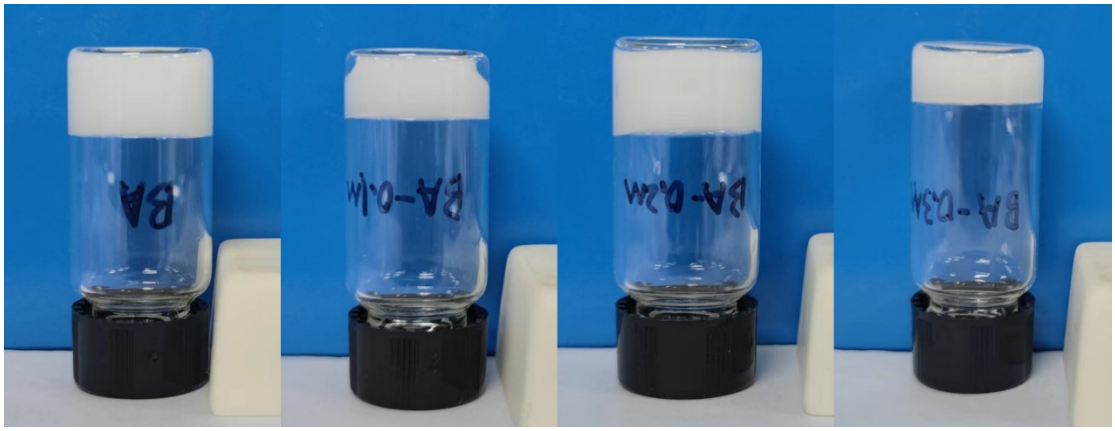

Fig.S1. the optical images of the polymerized elastomeric electrolytes with different amounts of LiDFOB.

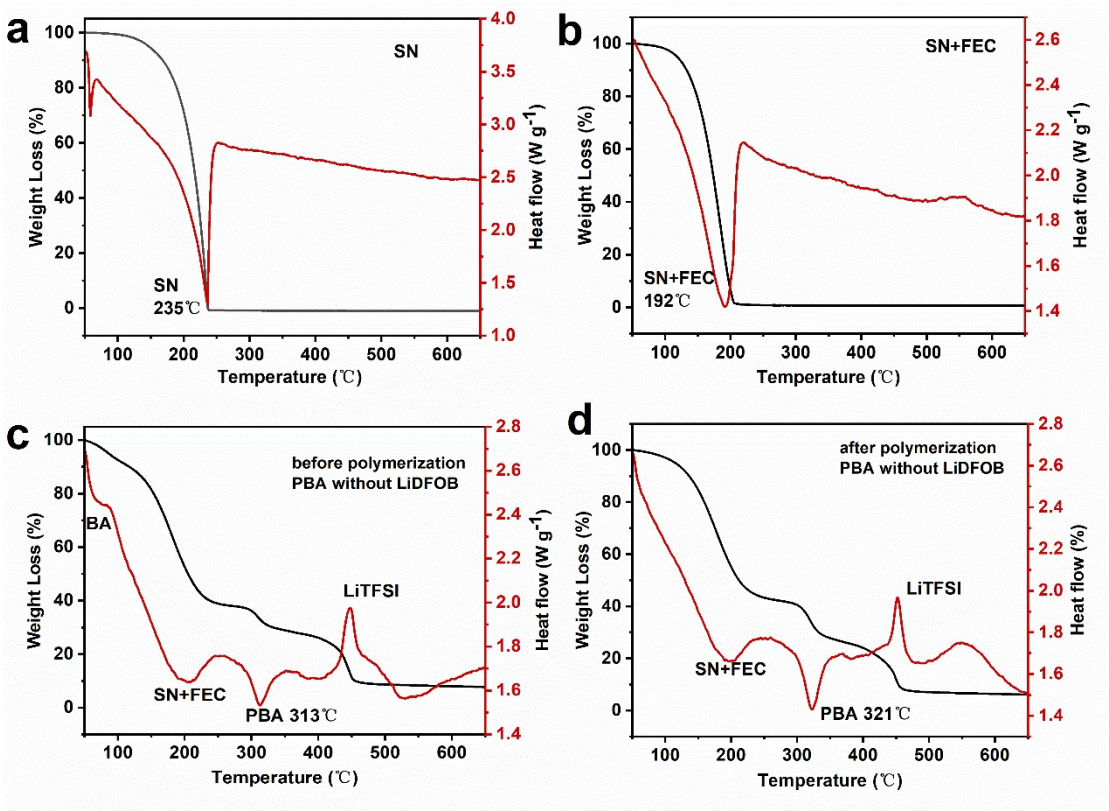

Fig.S2. TG-DSC profiles of SN (a), SN+FEC (b) and the precursors without LiDFOB, before polymerization (c) and after polymerization (d).

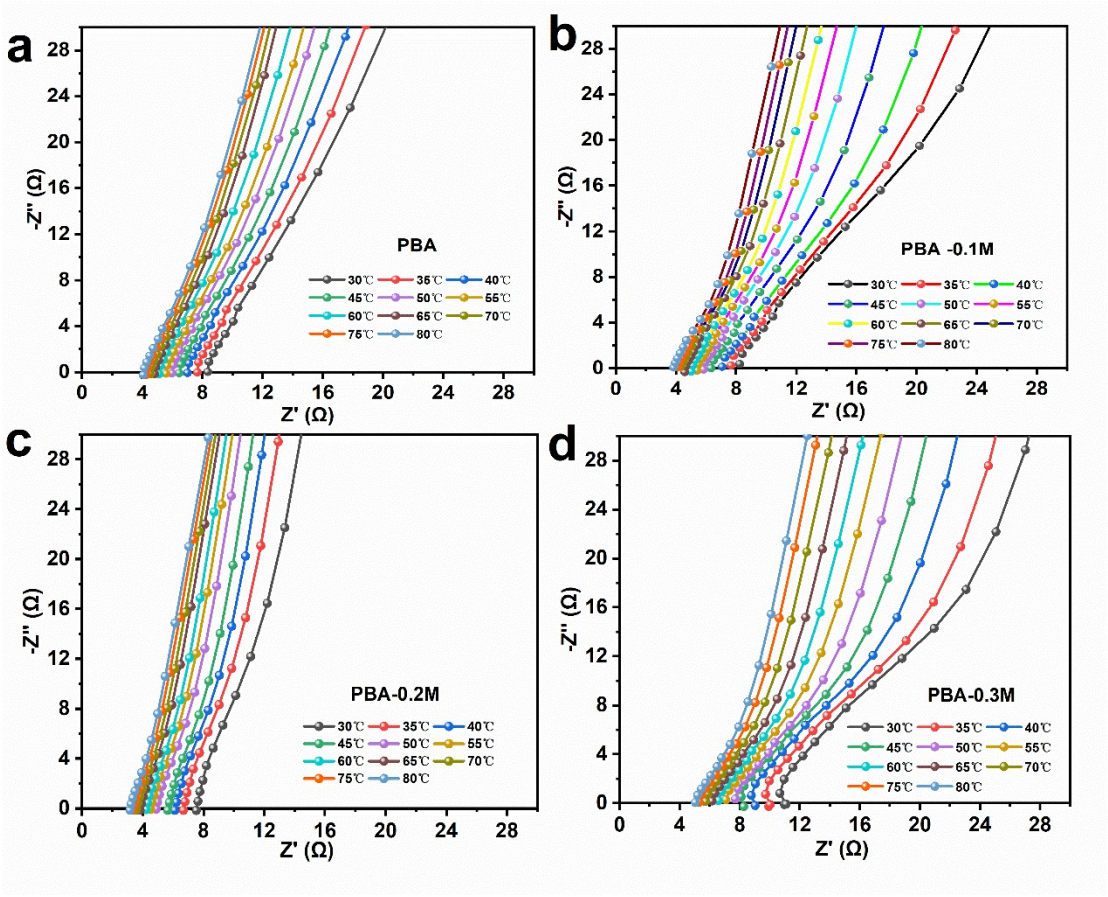

Fig.S3. The EIS profiles with different temperature (30~80 ℃) of the polymerized elastomeric electrolytes with different amount of LiDFOB, (a) PBA, (b) PBA-0.1M, (c) PBA-0.2M and (d) PBA-0.3M.

Tab.S1. The calculation for ionic conductivity of the prepared QSEs.

Type of QSE	Thickness L (μm)	Bulk Resistance R (Ω)	Contact area S (cm^{-2})	Ionic conductivity σ ($S\ cm^{-1}$)
PBA	25	8.39	1.766	1.69×10^{-4}
PBA-0.1M	25	8.29	1.766	1.70×10^{-4}
PBA-0.2M	25	7.63	1.766	1.86×10^{-4}
PBA-0.3M	25	10.68	1.766	1.28×10^{-4}

The diameter of SS is about 15 cm.

Tab. S2. The calculation for the Li transference number of the prepared QSEs.

Type of QSE	I_0 (μA)	I_{ss} (μA)	R_1 (Ω)	R_2 (Ω)	t_{Li^+}
PBA	34.02	29.46	232.3	237.6	0.63
PBA-0.2M	40.43	36.88	219.2	228.5	0.66

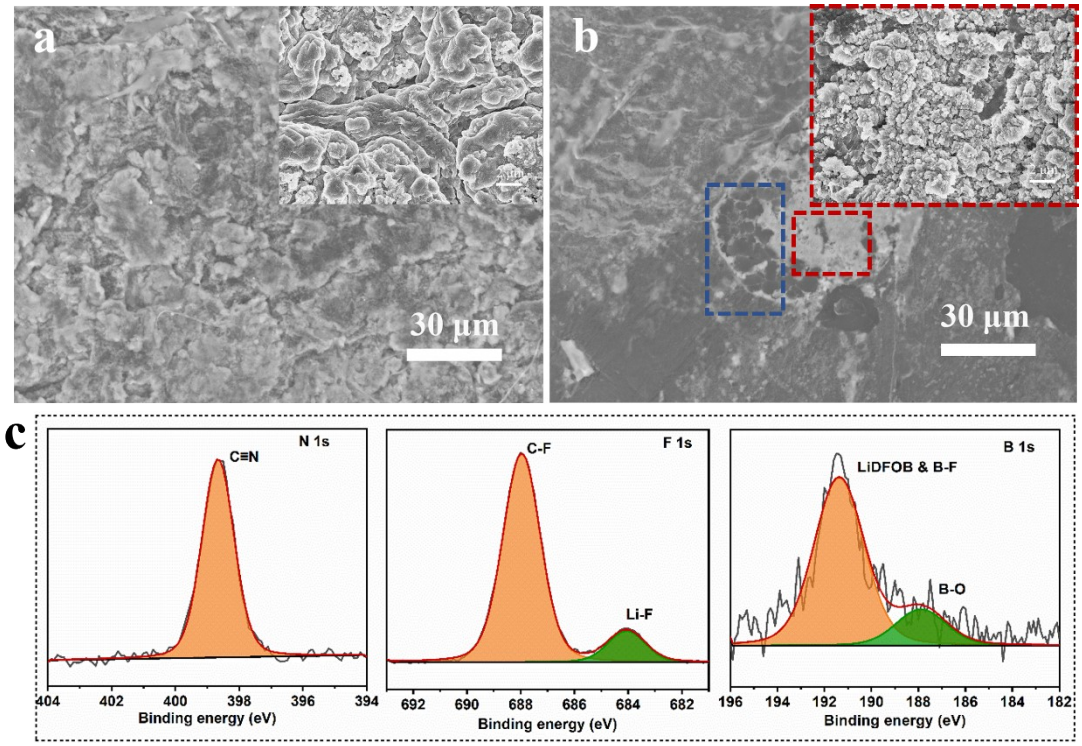

Fig.S4. SEM image of cycled lithium metal anodes in Li|PBA-0.1M|Li (a) and Li|PBA-0.3M|Li (b) symmetrical cells after 100 cycles at at 0.1 mA cm^{-2} and 0.1 mAh cm^{-2}.(c) XPS results of lithium anode from dissembled Li/PBA-0.3M/Li symmetric cell.

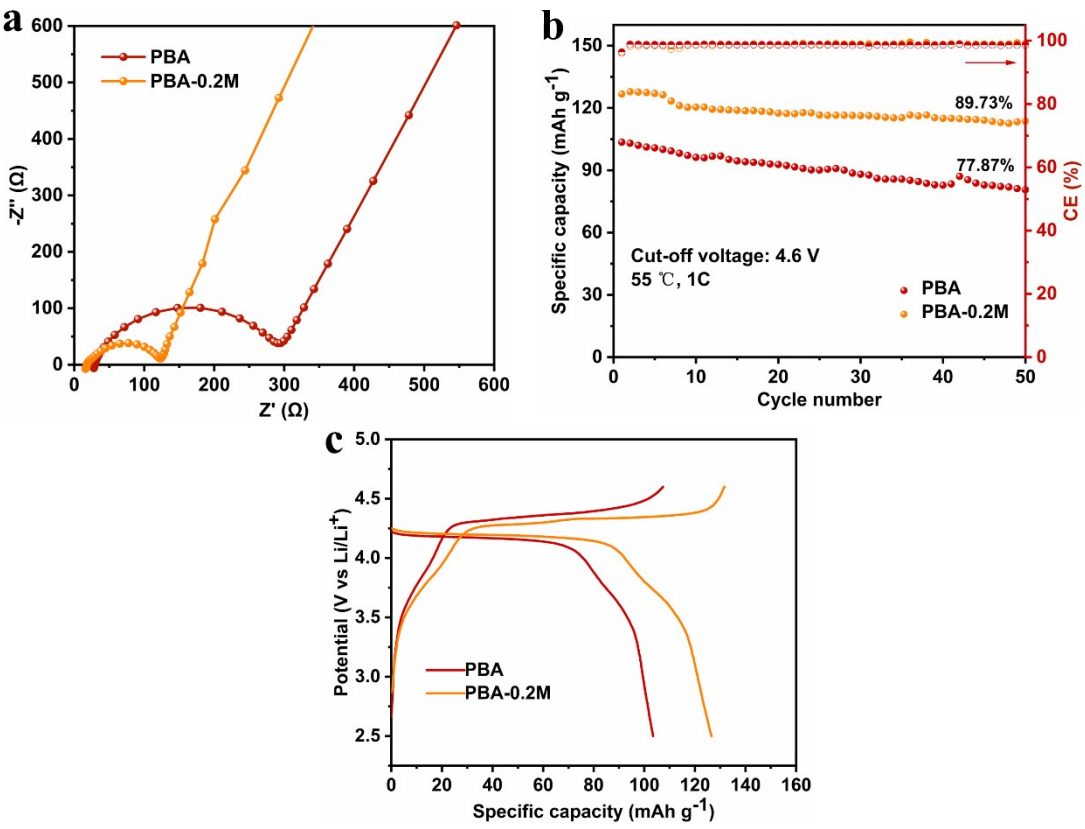

Fig.S5. (a) Nyquist plots of the Li/PBA/$LiVPO_4F$ and Li/PBA-0.2M/$LiVPO_4F$ with initial cycle at room temperature. (b) Cycling performance of Li/PBA/$LiVPO_4F$ and Li/PBA-0.2M/$LiVPO_4F$ cells at 55 ℃. (c) The initial charge-discharge curves at of Li/PBA/$LiVPO_4F$ and Li/PBA-0.2M/$LiVPO_4F$ cells at 55 ℃

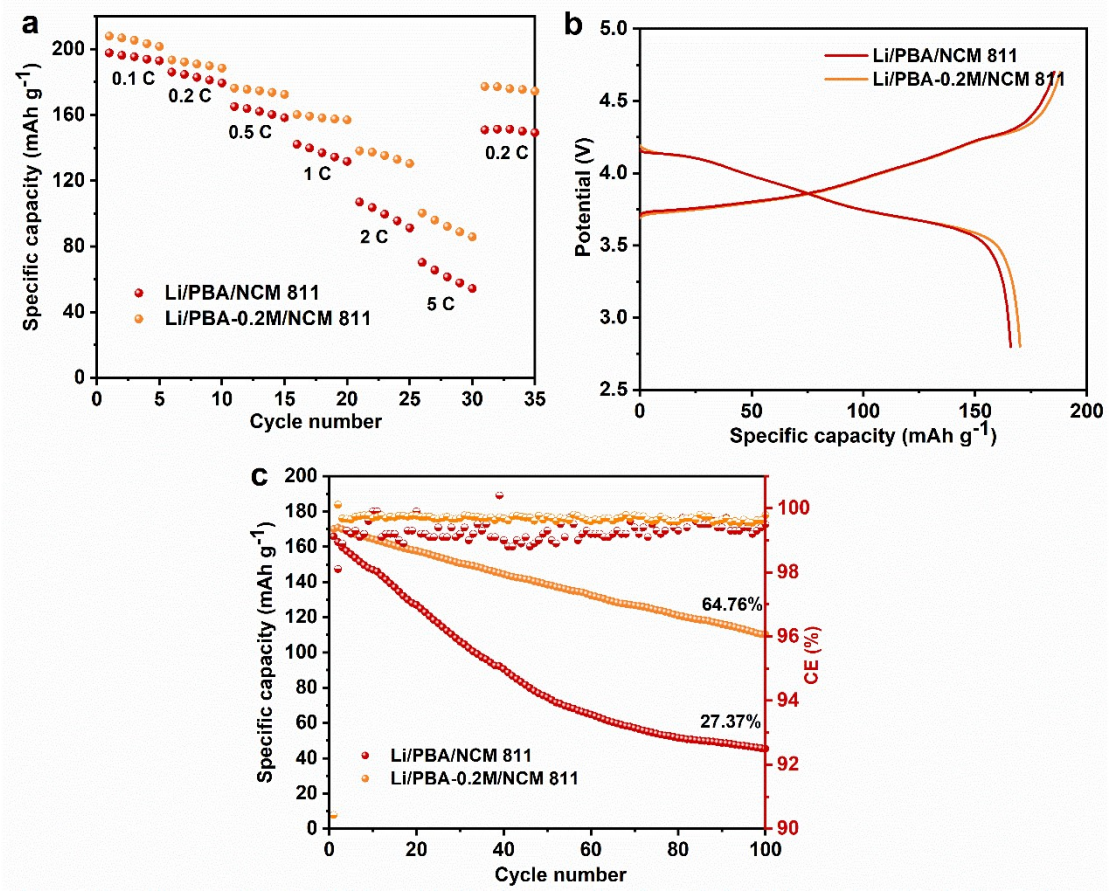

Fig.S6. Battery performance of Li/PBA/NCM811 and Li/PBA-0.2M/NCM 811 cells (a) Rate performance; (b) The initial charge-discharge curves; (c) Cycling performance.

Tab. S3. Comparison of ionic conductivity, electrochemical window and battery performance with different elastomeric electrolytes

System	Thickness	Ionic conductivity （25℃）	Electro-chemical Window	tLi+	Li/Li cell performance	Battery performance and cut-off voltage	Literature
PBA20 (Gel) LiFSI in EA/TMP/FEC	25 μm Celgard 2400	3.3×10^{-4} S cm^{-1}	4.27 V	0.63	~500 h (unclear)	LFP/ Li metal cell 153mAh g^{-1}, 1C ,94% after 500 cycles 3C, 114 mAh g^{-1} 4 V	[1]
PBA in GF LiTFSI in EA/TMP/FEC	Glass Fiber ≥200 μm	2.52×10^{-4} S cm^{-1}	5.04 V	0.56	0.1 mA cm^{-1} 0.1 mAh cm^{-1} ~260 h	LFP/Li cell 67.66 mAh g^{-1}, 1C 44.92 mAh g^{-1}, 2C 3.9 V	[2]
PU-EO_{12}/LiTFSI/$TEG_{41\%}$	unclear	4.8×10^{-4} S cm^{-1}	~5 V	0.4	0.1 mA cm^{-1} 0.1 mAh cm^{-1} 2200 h	LFP/Li cell 133.0 mA h g^{-1} ,0.5 C, 99.14% after 450 cycles 4.0 V	[3]
NBR/IBIL LiTFSI	120 μm	2.7 × 10−4 S cm−1	4.6 V	unclear	0.25 mA cm^{-1} 0.05 mAh cm^{-1} 600 h	LFP/Li cell 146 mA h g^{-1} ,0.5 C, 94.3% after 300 cycles 4.0 V	[4]
PBA-TMP-$LiNO_3$ QSE	25 μm	2×10^{-3} S cm^{-1}	4.6 V	0.8	unclear	LFP/Li cell ~ 155 mAh g^{-1} 1C, 92% 700 cycles 4.0 V	[5]
PBA-PVDF GPE	100 μm	8.1×10^{-4} S cm^{-1}	4.5 V	unclear	unclear	LFP/Li cell 85 mAh g^{-1} after 100 cycles 3.8 V	[6]
PBA-FEC-SN	25 μm	1.86×10^{-4} S cm^{-1}	5.36 V	0.67	0.5 mA cm^{-1} 0.5 mAh cm^{-1} 600 h	Li/$LiVPO_4F$ cell 121.5 mAh g^{-1}, 1C ~84.03% after 100 cycles, 4.7 V	This work

References

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