Electronic Supplementary Material (ESI) for Materials Chemistry Frontiers.

Supporting Information

In situ fabrication of fluorine-modified acrylate-based gel polymer electrolytes for lithium-metal batteries

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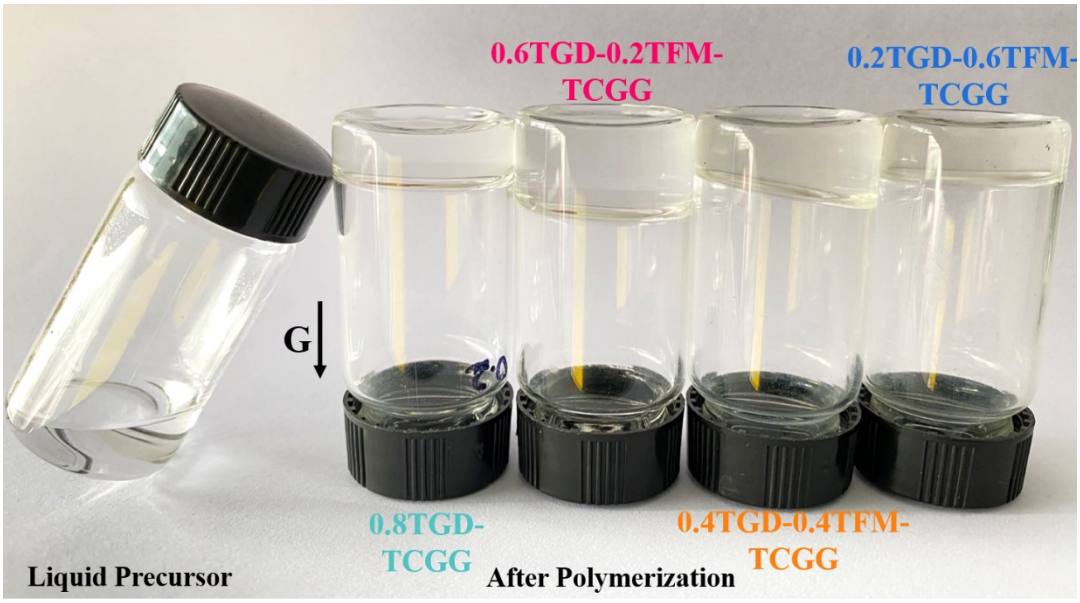

Fig. S1. Digital images of GPEs before and after thermal polymerization.

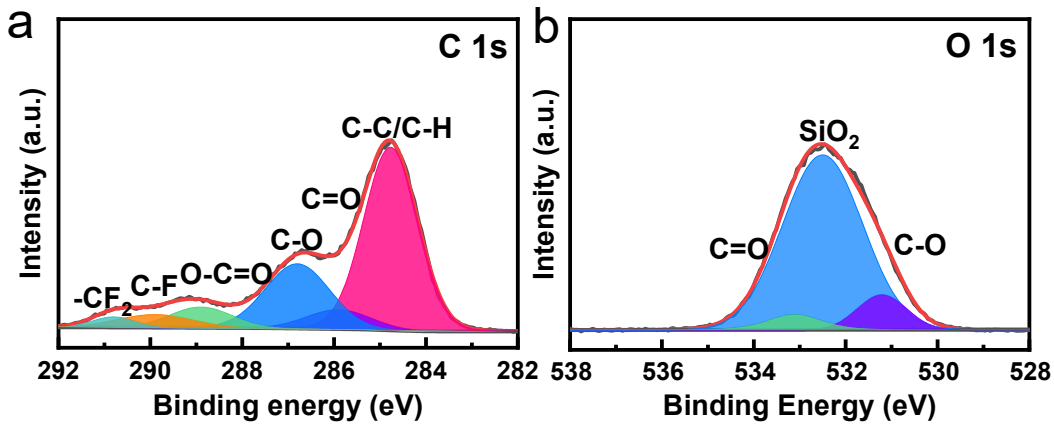

Fig. S2. XPS spectra on (a) C 1*s* and (b) O 1*s* of 0.4TGD-0.4TFM-TCGG-SiO_2NF.

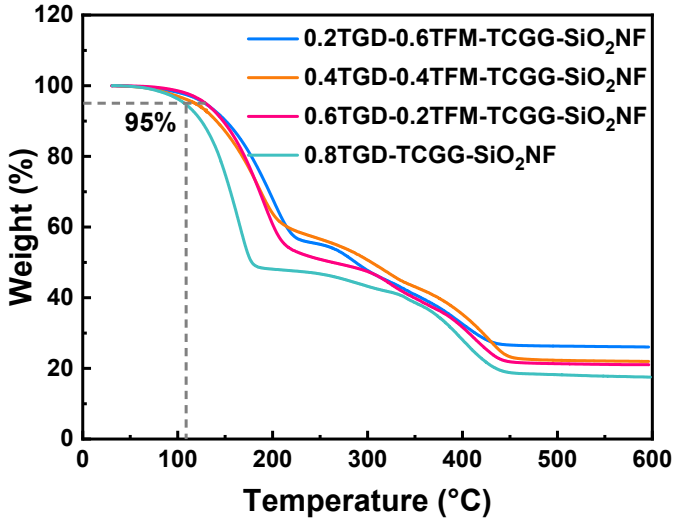

Fig. S3. TG curves of 0.8TGD-TCGG-SiO_2NF, 0.6TGD-0.2TFM-TCGG-SiO_2NF, 0.4TGD-0.4TFM-TCGG-SiO_2NF, and 0.2TGD-0.6TFM-TCGG-SiO_2NF.

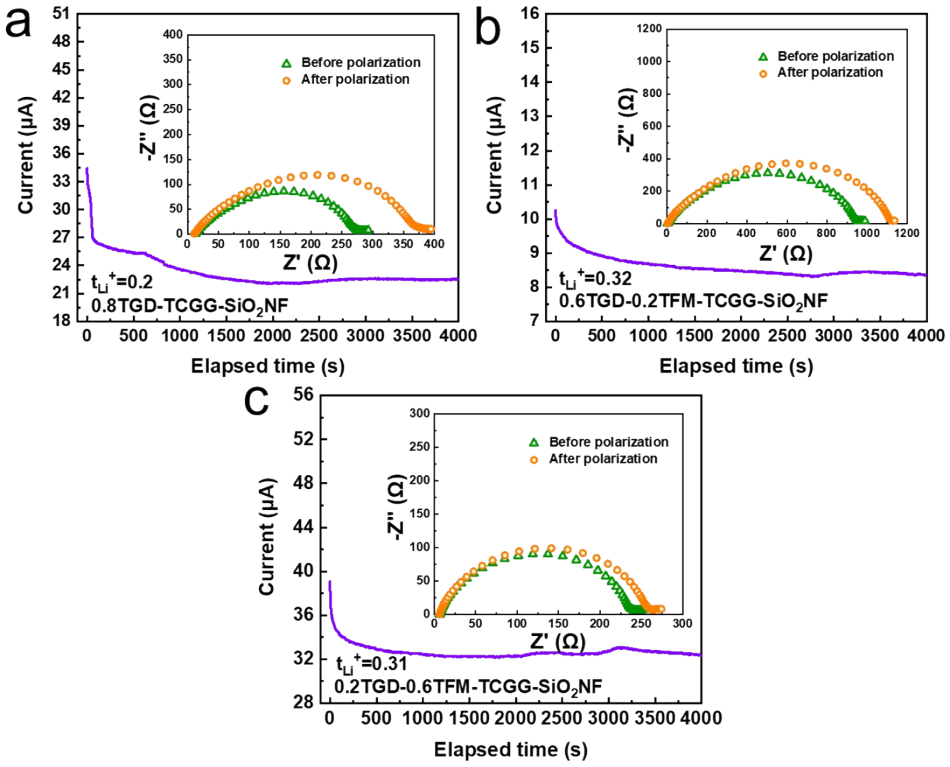

Fig. S4. Current and EIS curves of (a) 0.8TGD-TCGG-SiO_2NF, (b) 0.6TGD-0.2TFM-TCGG-SiO_2NF, and (c) 0.2TGD-0.6TFM-TCGG-SiO_2NF before and after polarization at 25 °C.

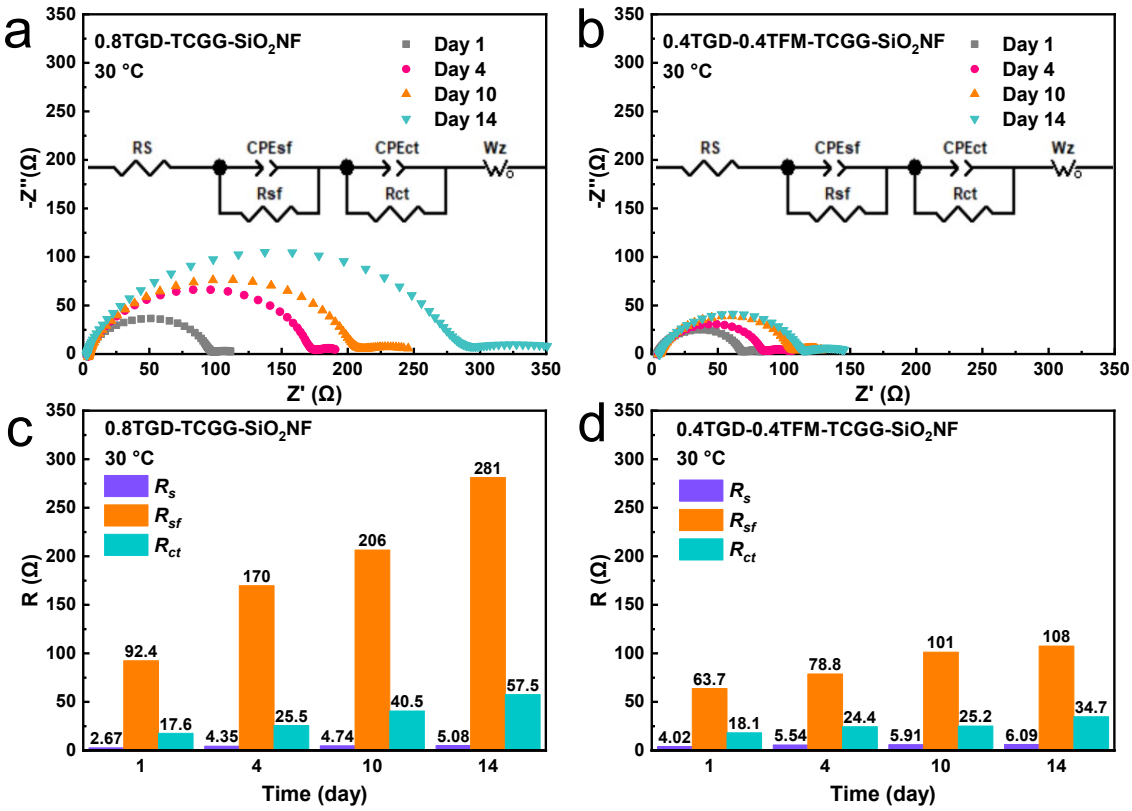

Fig. S5. EIS curves and fitting results of Li|0.8TGD-TCGG-SiO_2NF|Li and Li|0.4TGD-0.4TFM-TCGG-SiO_2NF|Li cells at 30 °C.

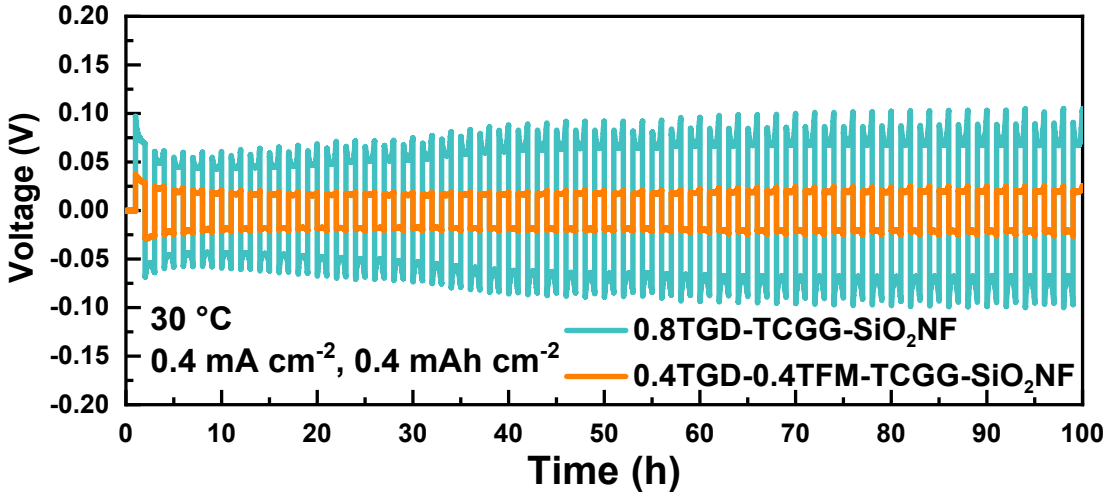

Fig. S6. Galvanostatic cycling profiles of Li|0.8TGD-TCGG-SiO_2NF|Li and Li|0.4TGD-0.4TFM-TCGG-SiO_2NF|Li cells at the current densities of 0.4 mA cm^{-2} with a restricted specific capacity of 0.4 mAh cm^{-2} at 30 °C.

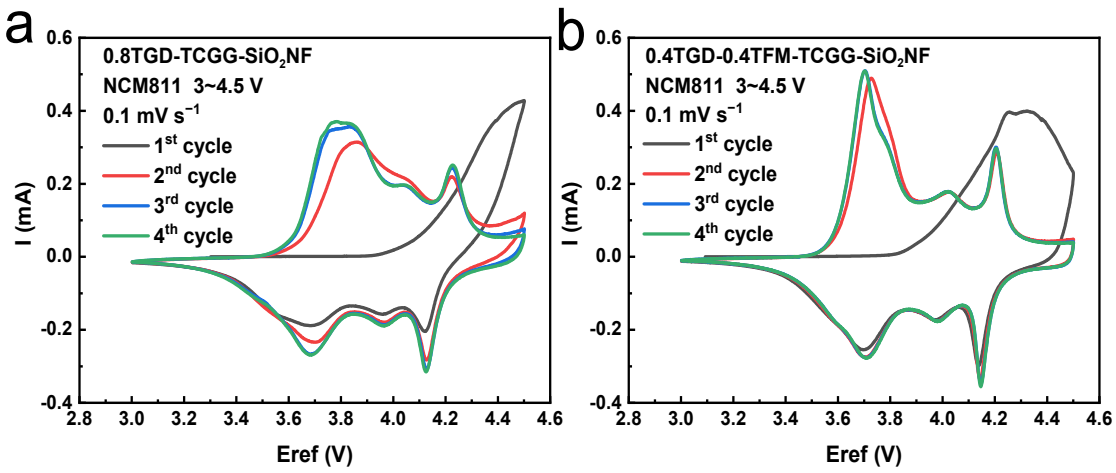

Fig. S7. CV curves of (a) NCM811|0.8TGD-TCGG-SiO_2NF|Li and (b) NCM811|0.4TGD-0.4TFM-TCGG-SiO_2NF|Li batteries at 3.0 ~ 4.5 V with a scan rate of 0.1 mV s^{-1} at 30 °C.

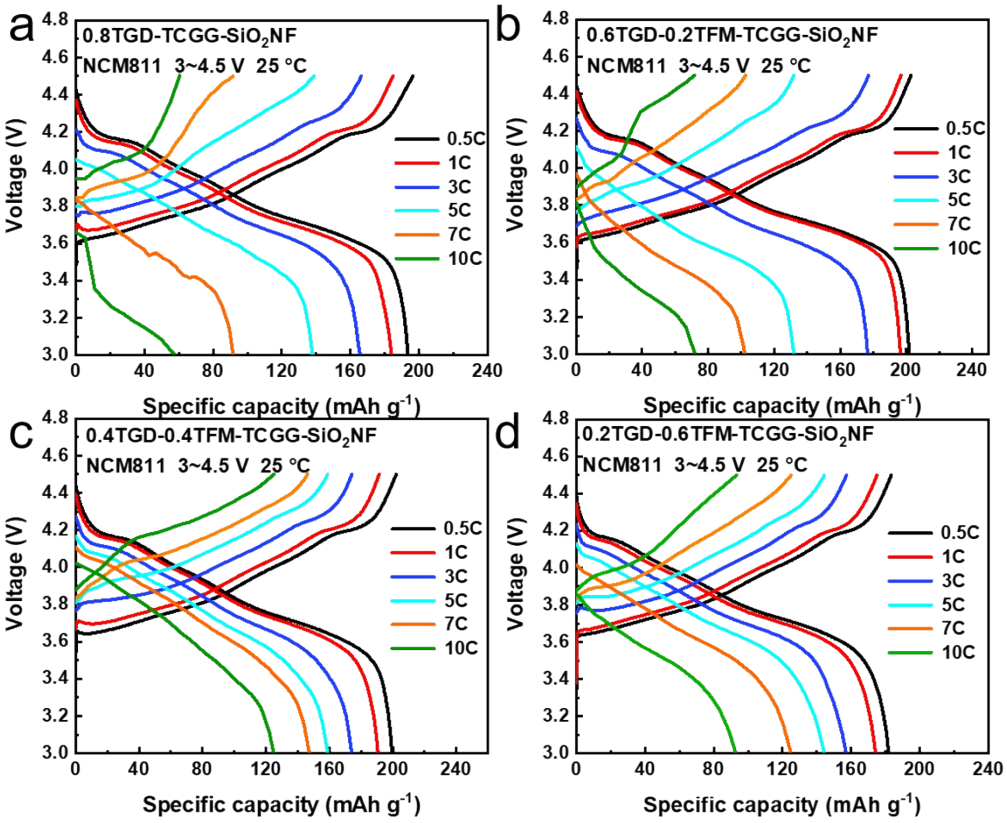

Fig. S8. Voltage profiles of (a) NCM811|0.8TGD-TCGG-SiO_2NF|Li, (b) NCM811|0.6TGD-0.2TFM-TCGG-SiO_2NF|Li, (c) NCM811|0.4TGD-0.4TFM-

TCGG-SiO_2NF|Li, and (d) NCM811|0.2TGD-0.6TFM-TCGG-SiO_2NF|Li batteries at various C-rate.

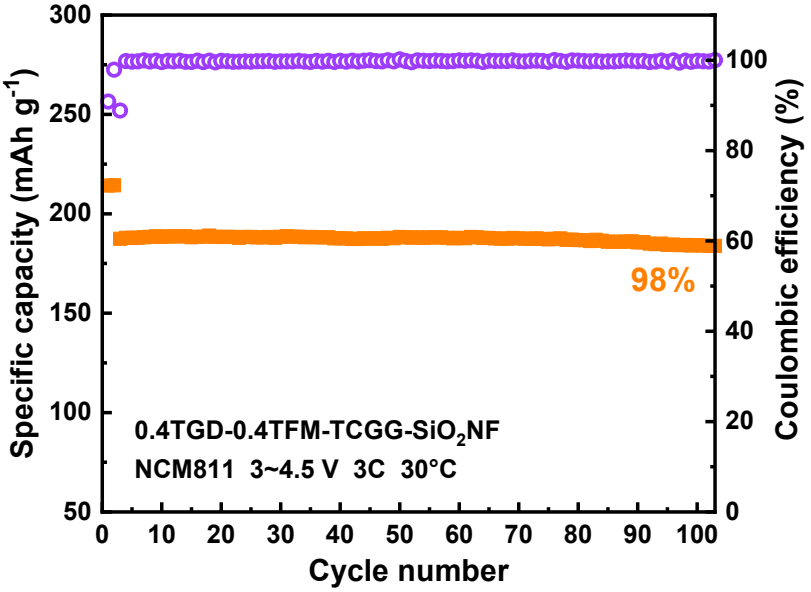

Fig. S9. Cycling performance of NCM811|0.4TGD-0.4TFM-TCGG-SiO_2NF|Li battery at 3C.

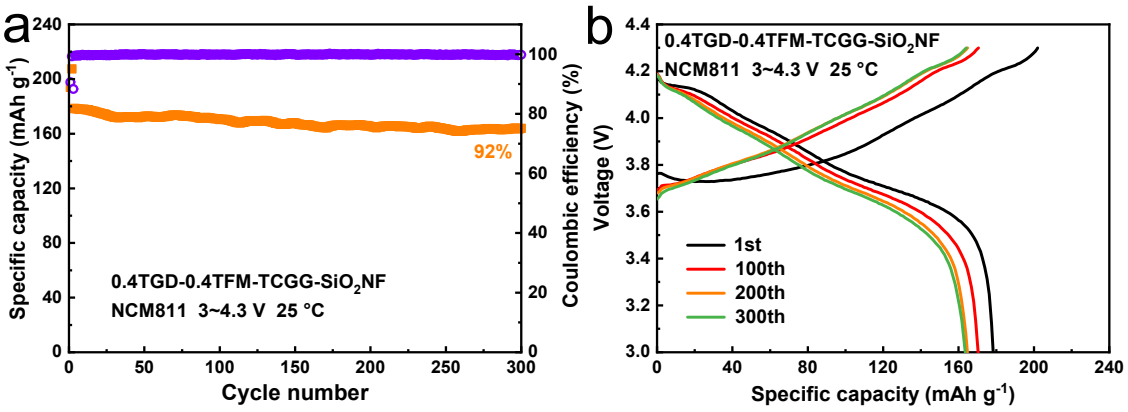

Fig. S10. (a) Cycling performance and (b) voltage profiles of NCM811|0.4TGD-0.4TFM-TCGG-SiO_2NF|Li battery at 2C.

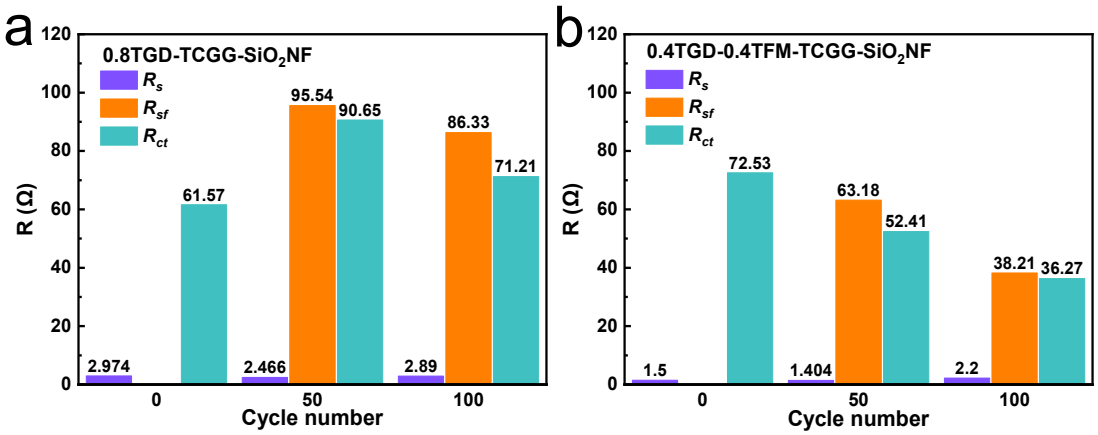

Fig. S11. R_s, R_{sf}, and R_{ct} variation of NCM811|0.8TGD-TCGG-SiO_2NF|Li and NCM811|0.4TGD-0.4TFM-TCGG-SiO_2NF|Li batteries.

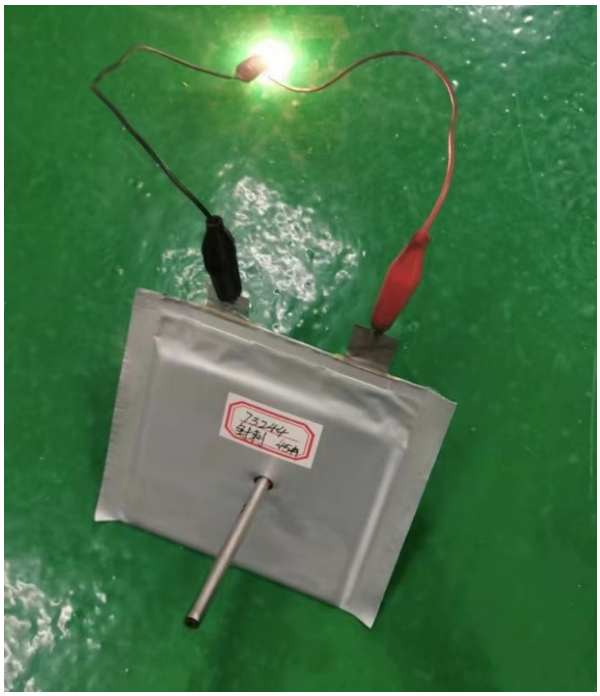

Fig. S12. Pinprick testing of pouch battery.

Table. S1. Composition of different GPEs.

	TGD (g)	TFM (g)	TCGG (g)	AIBN (mg)
0.8TGD-TCGG	0.8	0	4.5	8
0.6TGD-0.2TFM-TCGG	0.6	0.2	4.5	8
0.4TGD-0.4TFM-TCGG	0.4	0.4	4.5	8
0.2TGD-0.6TFM-TCGG	0.2	0.6	4.5	8

Table. S2. Ionic conductivities (σ) of GPEs.

	0.8TGD-TCGG-SiO_2NF (S cm^{-1})	0.6TGD-0.2TFM-TCGG-SiO_2NF (S cm^{-1})	0.4TGD-0.4TFM-TCGG-SiO_2NF (S cm^{-1})	0.2TGD-0.6TFM-TCGG-SiO_2NF (S cm^{-1})
30 °C	1.67×10^{-4}	2.60×10^{-4}	3.56×10^{-4}	2.15×10^{-4}
40 °C	1.97×10^{-4}	2.74×10^{-4}	4.21×10^{-4}	2.57×10^{-4}
50 °C	2.35×10^{-4}	3.02×10^{-4}	4.70×10^{-4}	3.24×10^{-4}
60 °C	2.73×10^{-4}	3.10×10^{-4}	4.80×10^{-4}	3.58×10^{-4}
70 °C	3.05×10^{-4}	3.29×10^{-4}	5.00×10^{-4}	3.79×10^{-4}
80 °C	3.17×10^{-4}	3.53×10^{-4}	5.10×10^{-4}	4.10×10^{-4}

Table. S3. The electrochemical performances of this work and reported GPEs.

Battery	t_{Li^+}	Test conditions	Initial capacity (mAh g^{-1})	Cycles capacity retention	Reference
NCM811|TFEMA-VEC|Li	0.44	3~4.5 V 25 °C	1C, 218	300th, 70%	[1]
LFP|PEGDMA-ETFP/Li	0.42	2.5~3.8 V 25 °C	0.5C, 142.1	100th, 98%	[2]
NCA|MA-HFMA-MMA|Li	0.47	3~4.3 V 25 °C	0.5C, 162.2	200th, 91%	[3]
LFP|PEGDA-ETPTA|Li	0.7	2.5~4.0 V 25 °C	1C, 124.4	200th, 76%	[4]
LCO|PVCA|Li	0.57	2.5~4.3 V 50 °C	0.1C, 146.0	150th, 82%	[5]
NCM811|0.4TGD-0.4TFM-TCGG-SiO_2NF|Li	0.57	3~4.3 V 25 °C	2C, 178.4	300th, 92%	This work
		3~4.5 V 25 °C	2C, 184.2	260th, 91%	

References

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