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Supporting information

High Electrochemical Stability of 3D Cross-linked Network PEO@nano-SiO2 Composite Polymer Electrolyte for Lithium Metal Batteries

Yinghua Zhu,[a,b] Jiang Cao,[*a,d] Hong Chen,[b,c] Qipeng Yu,[a] and Baohua Li,[*a]

[a] Engineering Laboratory for Functionalized Carbon Materials and Engineering Laboratory for the Next Generation Power and Energy Storage Batteries Graduate School at Shenzhen, Tsinghua University, Shenzhen 518055, P. R. China

[b] College of Material Science and Engineering, Central South University of Forestry and Technology, Changsha 410004, Hunan, P. R. China

[c] School of Materials Science and Energy Engineering, Foshan University, Foshan 528000, Guangdong, P. R. China

[d] R&D Center, Shenzhen Senior Technology Material Co., LTD, Shenzhen 518106, P. R. China

Table S1. Results of electrolyte uptake ability tests

Sample	Uptake (wt%)	Ionic conductivity (S cm^{-1})
3D-GPE	300.9%	2.3×10^{-3}
4%-SiO_2-GPE	276%	3.2×10^{-3}
3D-GCPE4	340%	4.65×10^{-3}
3D-GCPE8	274%	2.2×10^{-3}

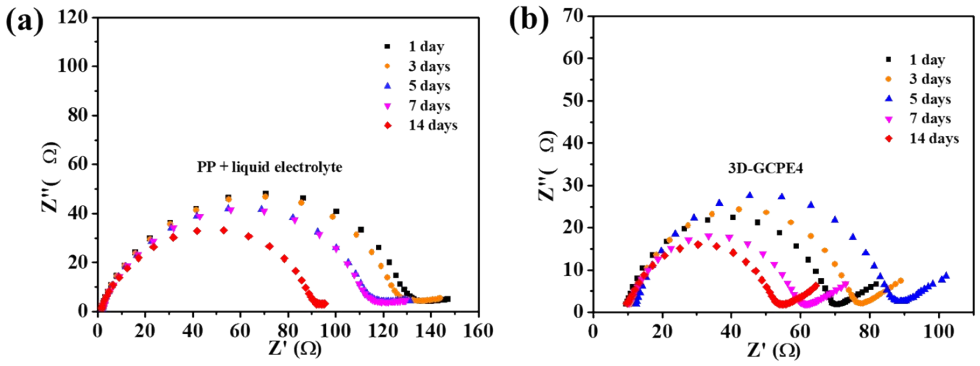

Fig. S1. Electrochemical impedance spectra of a symmetric cell Li/Electrolyte/Li after different aging time at room temperature (a) PP+ liquid electrolyte, (b) 3D-GCPE4.

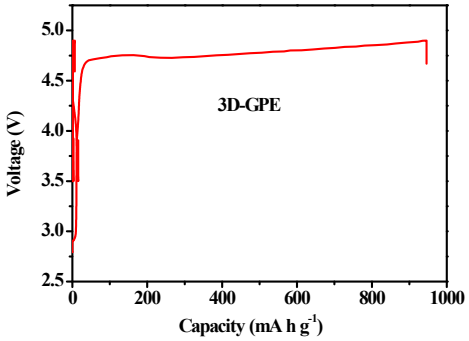

Fig. S2 Charge/discharge voltage profile of Li/3D-GPE/ $LiNi_{0.5}Mn_{1.5}O_4$ at 0.5C.

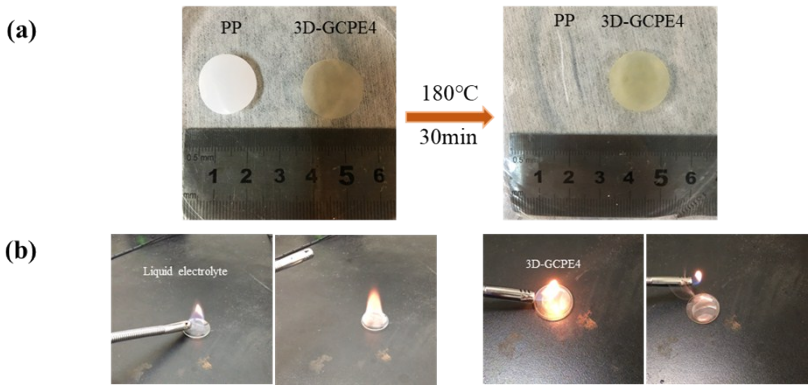

Fig. S3. (a) photographs of thermal shrinkage of PP separator and 3D-GCPE4 membrane at 180 °C for 30 min. (b) Flammability testing for liquid electrolyte and 3D-GCPE4, samples were exposed to flame for 5s.

Fig. S3a is the dimension thermal stability of dimensional thermal stability experiment. After exposure to 180 °C for 30 min, PP separator sharply shrank and partially melted, while the 3D-GCPE4 membrane still retains original feature with negligible change in its dimensions. Fig. S3b is combustion test of the 1M $LiPF_6$ in EC/DMC/DEC and 3D-GCPE4. After exposure to flame for 5s, the liquid electrolyte exhibits high flammability. on the contrary, the 3D-GCPE4 exhibits low flammability and did not continue to burn.

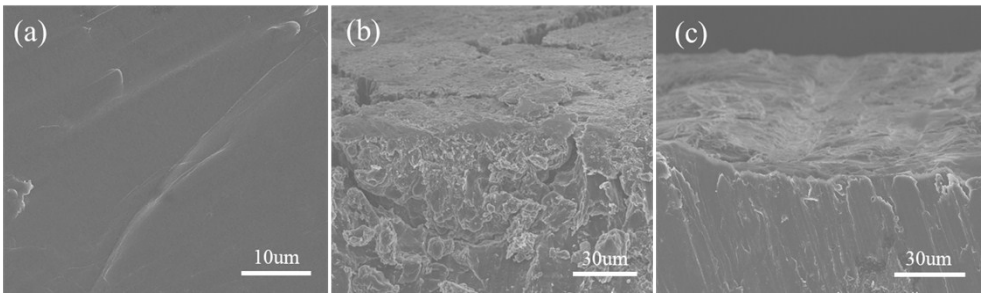

Fig. S4. SEM images of (a) fresh lithium metal surface. cross-section of lithium metal after 200 cycles at 1C with a configuration of (b) Li/PP + liquid electrolyte/LiFePO4 cell. (c) Li/3D-GCPE4/LiFePO4 cell.

Fig. S4a is the SEM image of fresh lithium metal surface, which was smooth and without cracks. Fig. S4b, c show the SEM images of cross-section of lithium metal after 200 cycles at 1C. The lithium metal with PP + liquid electrolyte was cracked and pulverized, while the lithium metal with 3D-GCPE4 was still smooth and compact.