Supplementary Information

$Li_7La_3Zr_2O_{12}$ ceramic nanofiber-incorporated composite polymer electrolytes for lithium metal batteries

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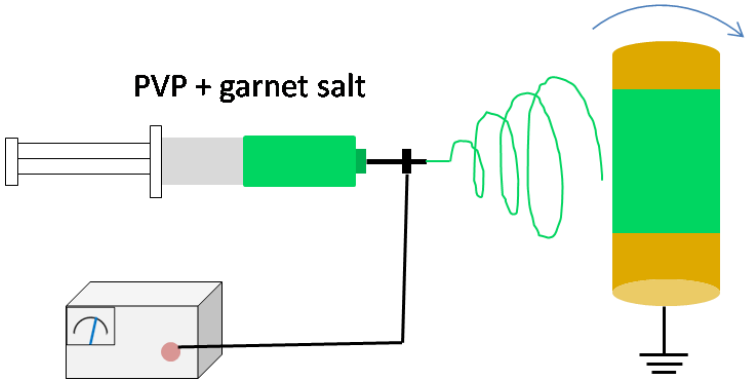
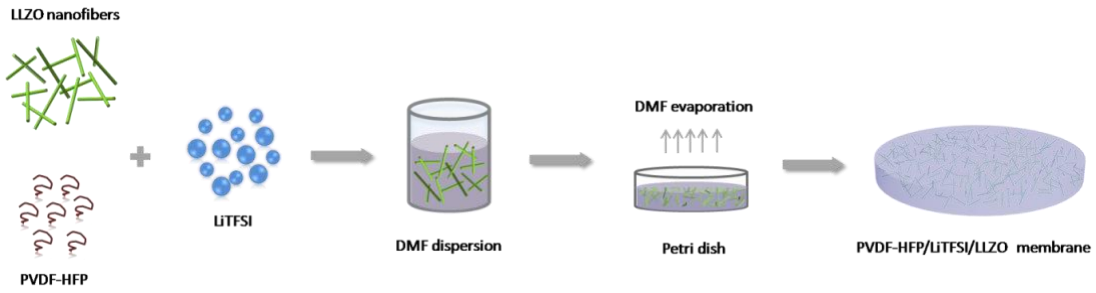


Scheme S1. Schematic electrospinning setup of garnet-PVP nanofibers.



Scheme S2. Schematic procedure for the fabrication of the PVDF-HFP/LiTFSI/LLZO membranes.

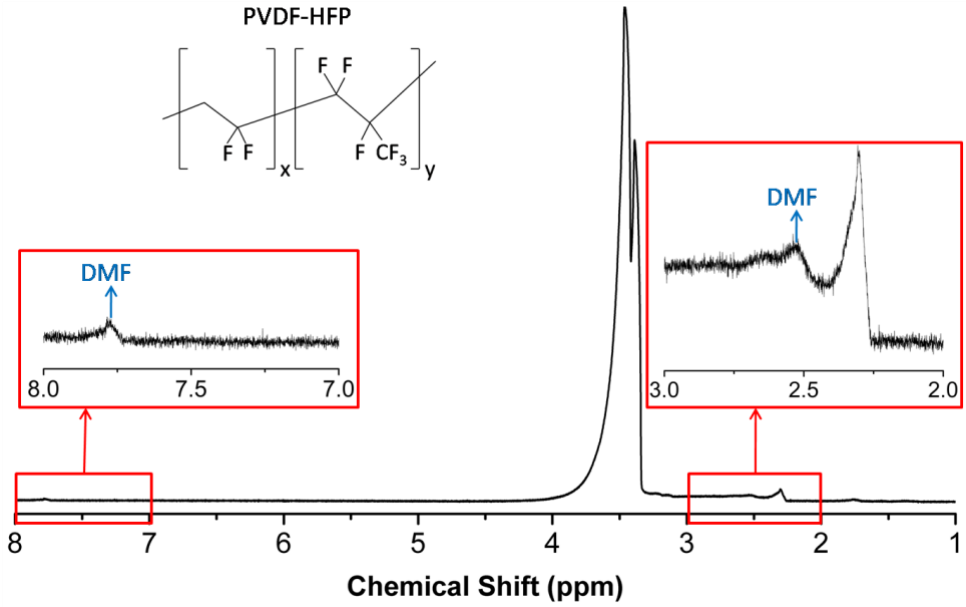


Fig. S1. ^{1}H NMR measurement of PVDF-HFP/LiTFSI/LLZO membrane.

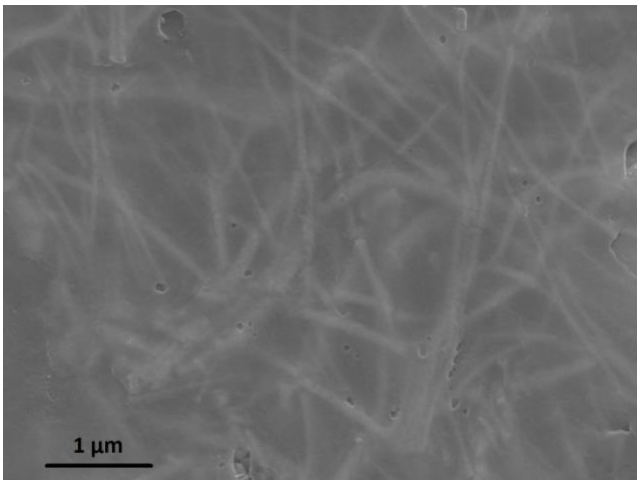


Fig. S2. SEM image of the PVDF-HFP/LiTFSI/LLZO membrane with 20 wt% LLZO nanofibers.

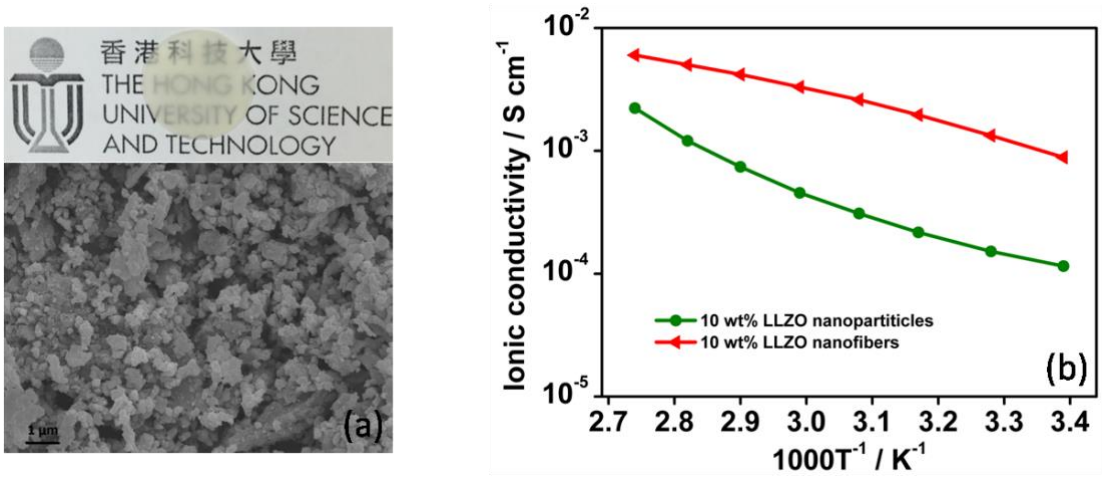


Fig. S3. (a) SEM image of LLZO nanoparticles, and photo of PVDF-HFP-based electrolyte with LLZO nanoparticles. (b) Comparison of ionic conductivity of CPEs containing LLZO nanofibers and LLZO nanoparticles.

Table S1. Liquid electrolyte uptakes in PVDF-HFP/LiTFSI/LLZO CPEs.

Sample	W_0 (g)	W_1 (g)	Uptake
1	0.072	0.08	11.1%
2	0.067	0.074	10.4%
3	0.075	0.082	9.3%

Liquid electrolyte uptakes were measured by weighting method. First, the dry PVDF-HFP/LiTFSI/LLZO CPE membranes were cut into round pieces and weighted as W_0. After soaked in PC/LiTFSI liquid electrolyte solution for 20 min, the excess electrolyte solution on the surface of the membranes was removed by wiping with a tissue paper, and then weighted as W_1. The liquid uptake is calculated by the following equation:

$$\text{Uptake (\%)} = (W_1 - W_0)/W_0 \times 100\%$$

Table S2. A comparison of ionic conductivities and mechanic properties of PVDF or PVDF-based gel or solid polymer electrolytes (GPE or SPE) from representative works and ours.[1–8]

	Electrolyte	Liquid electrolyte uptake (%)	Ionic conductivity (mS cm^{-1})	Stress (MPa)/ Stress (%)
	PVDF-HFP/LLZO	10	0.95	5.3/25
GPE	PVDF/cellulose	267	1.33	2.83/5.92
	PVDF-HFP/Al_2O_3	371	0.7	17/20
	PVDF-HFP/TiO_2	125	0.98	9.69/74.4
	PVDF-HFP/$BaTiO_3$	462	0.104	–/–
	PVDF-HFP/PEO/GO	368	2.1	–/–
	PVDF-HFP/PEO/PMMA	75	0.81	–/–
	PVDF/polymer-blend	81	3.5	–/–
SPE	PVDF/PMMA	0	0.031	–/–
	PVDF-HFP	0	0.078	–/–

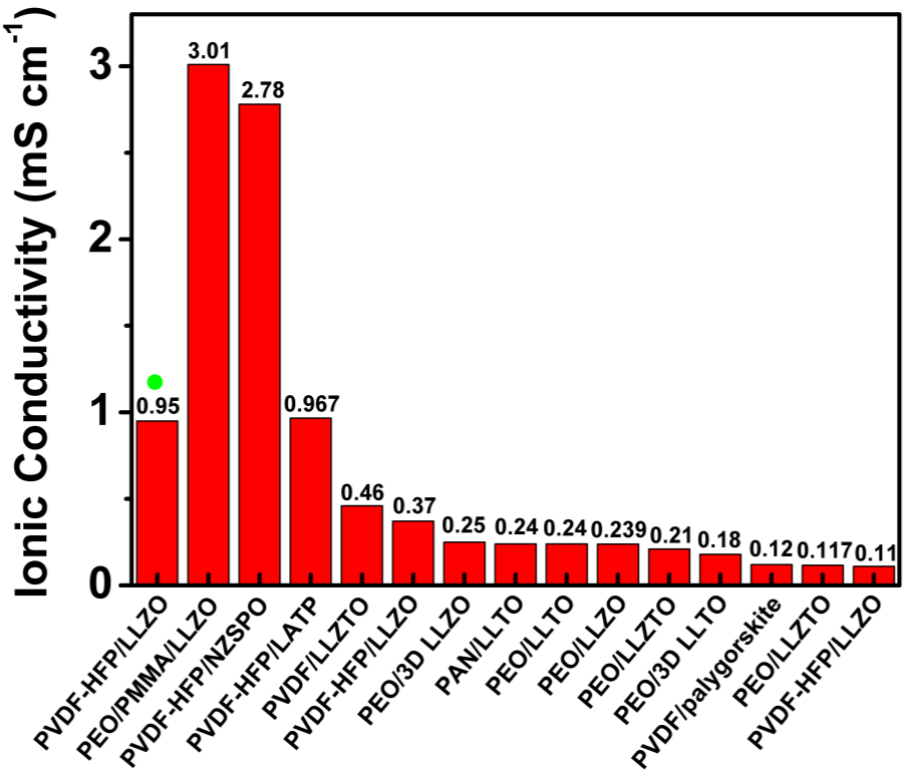


Fig. S4. A comparison of ionic conductivities of ceramic nanofiller-incorporated composite polymer electrolytes from representative works and ours.[9–22]

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