Support Information

Halide-sulfide bilayer electrolytes for $LiFePO_4$-based all-solid-state batteries

Guoyao Zhang [a], Xixi Shi [a], Qili Su [b], Yiming Sun [c], Yong Lu [b], Kai Liu [a*], Zhe Li [b*], Haijing Liu [b*], Lianqi Zhang [a*]

[a] School of Materials Science and Engineering, Tianjin University of Technology, Tianjin 300384, China

[b] China Science Lab, General Motors Global Research & Development, Shanghai 201206, China

[c] School of Materials Science and Engineering, Tianjin University, Tianjin 300350, China

[*] Corresponding author. E-mail: liukai_tju_edu_cn@163.com (K. Liu), zhe.4.li@gm.com (Z. Li), helen.liu@gm.com (H. Liu), tianjinzhanglq@163.com (L. Zhang)

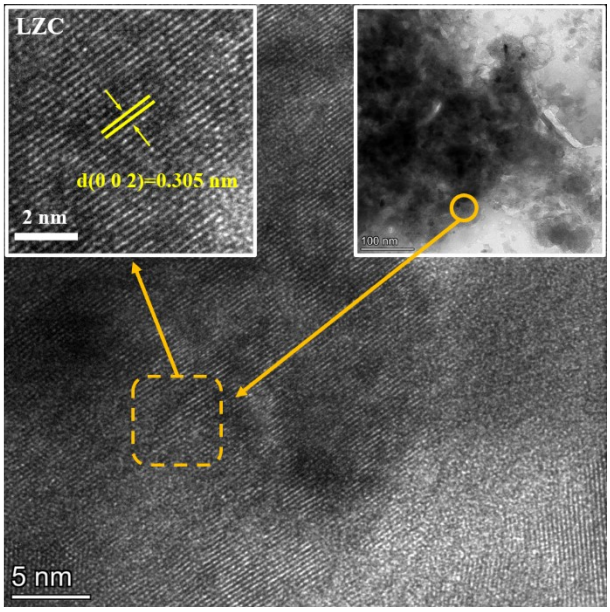

Fig. S1. HRTEM plots of LZC

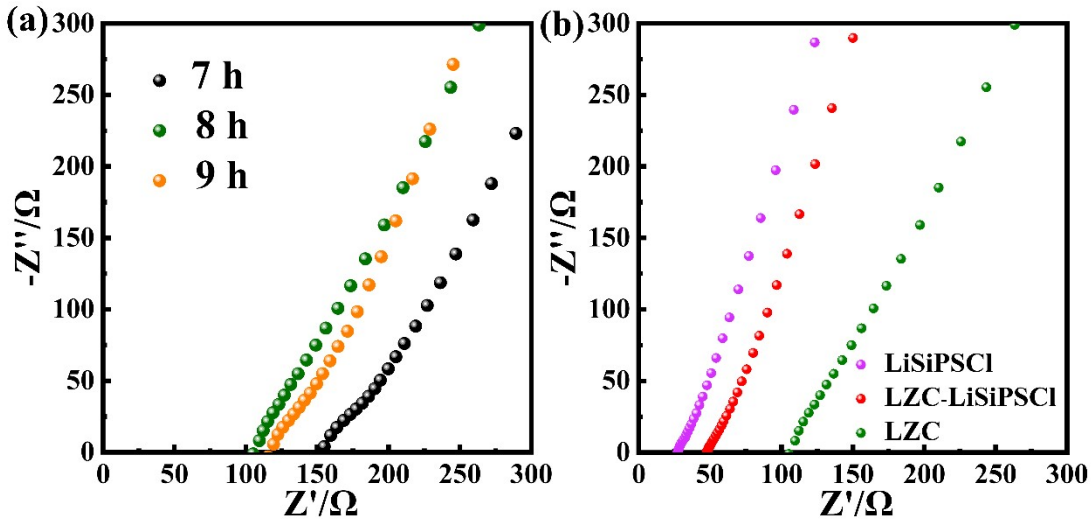

Fig. S2. Nyquist plots of (a) LZC after different ball milling times, (b) LiSiPSCl and LZC-LiSiPSCl at room temperature.

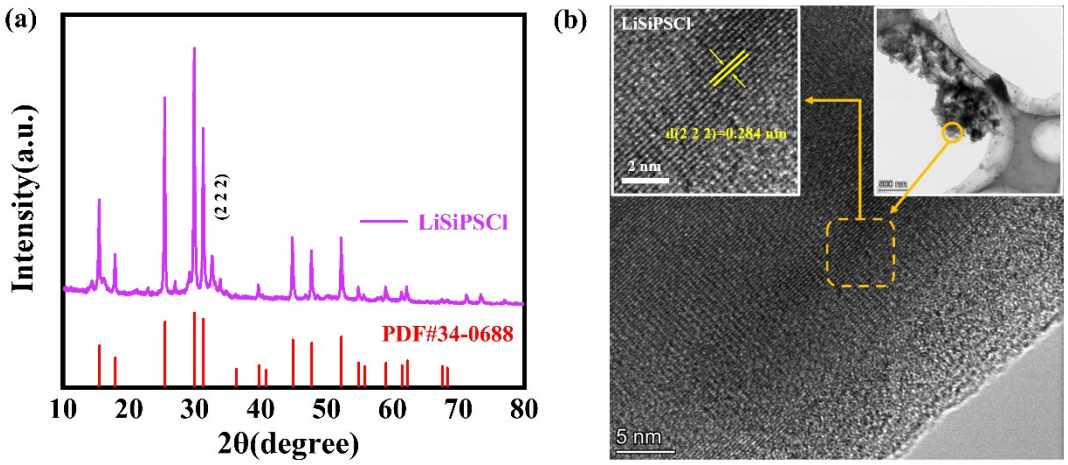

Fig. S3. (a) XRD and (b) HRTEM plots of LiSiPSCl

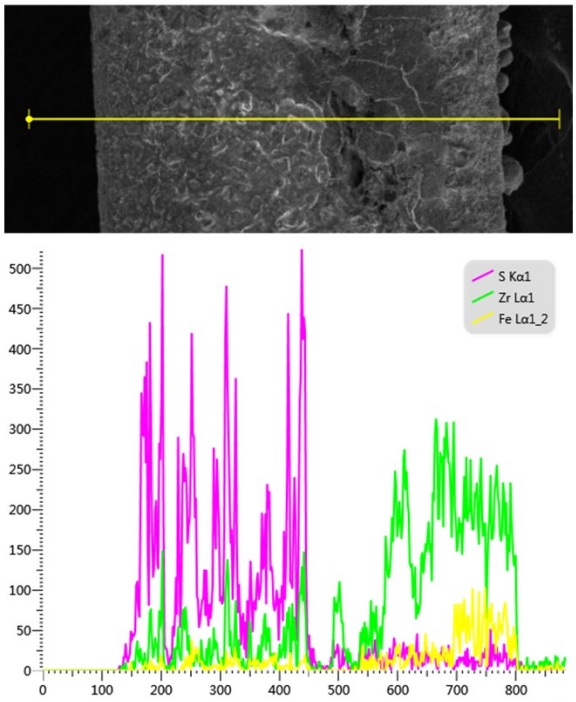

Fig. S4. Cross-sectional line scan of LFP-LZC/LZC/LiSiPSCl/Li-In ASSBs.

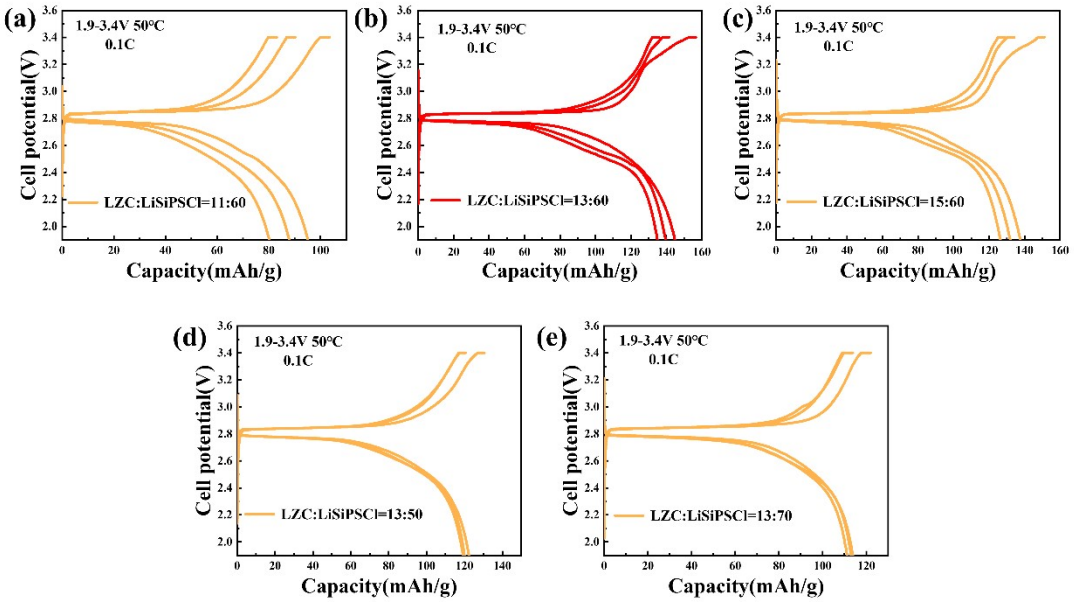

Fig. S5. Electrochemical performance of all-solid-state batteries assembled with different ratios of LZC solid-state electrolytes and LiSiPSCl solid-state electrolytes

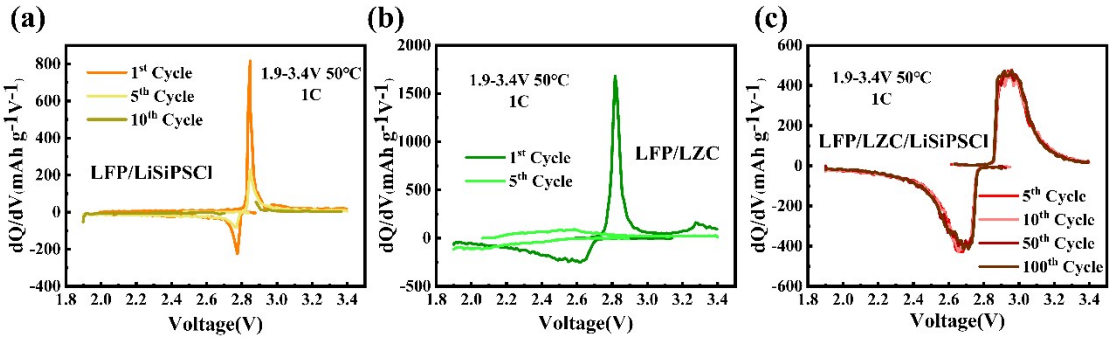

Fig. S6. dQ/dV curves for different number of cycles for (a) LiSiPSCl, (b) LZC and (c) LZC-LiSiPSCl cells.

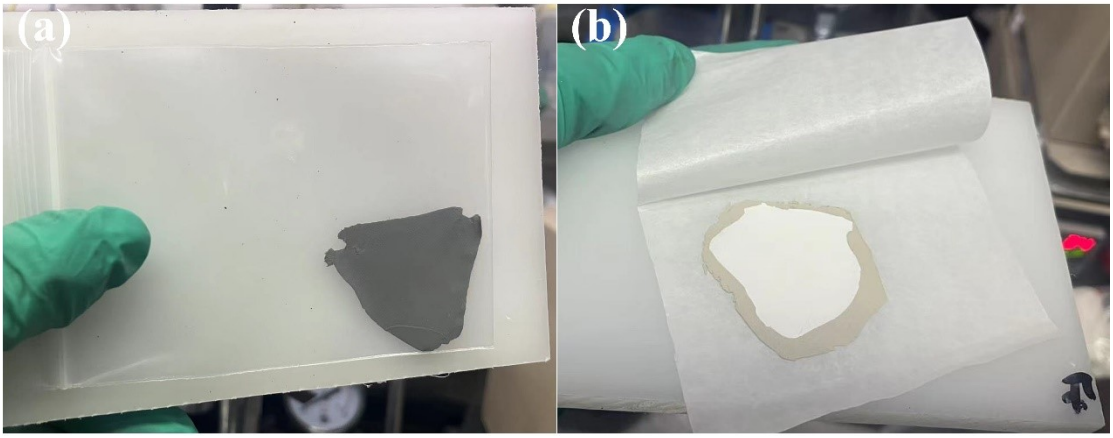

Fig. S7. (a) LFP composite positive electrode and (b) LZC-LiSiPSCl bilayer electrolyte prepared as lamellar membrane.

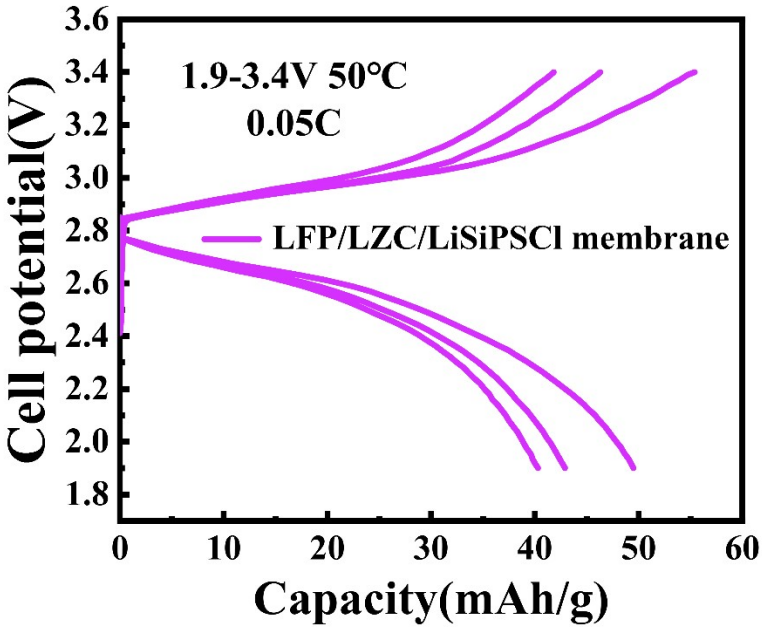

Fig. S8. Electrochemical performance of LFP all-solid-state membrane batteries.

Table. S1. Fitting data for LiSiPSCl, LZC and LZC-LiSiPSCl cycle EIS and error values.

Composite	Cycle	Resistance (Ω)			δ (%)
		SSE/Bulk	SEI	CT	
LFP/LiSiPSCl	1st	12	47	278	0.136
	100st	20	212	3800	0.203
LFP/LZC	1st	69	21	\	0.145
	100st	140	493	\	0.167
LFP/LZC/LiSiPSCl	1st	29	9	\	0.138
	100st	28	33	\	0.120