Supporting Information

Micro-Sized MoS_6@15%$Li_7P_3S_{11}$ Composite Enables Stable All-Solid-State Battery with High Capacity

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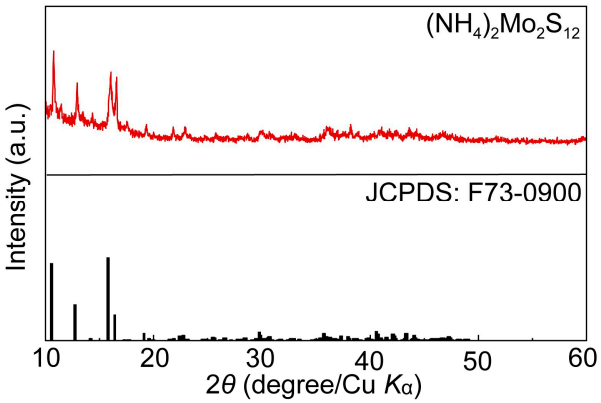

Figure S1. XRD pattern of $(NH_4)_2Mo_2S_{12}$.

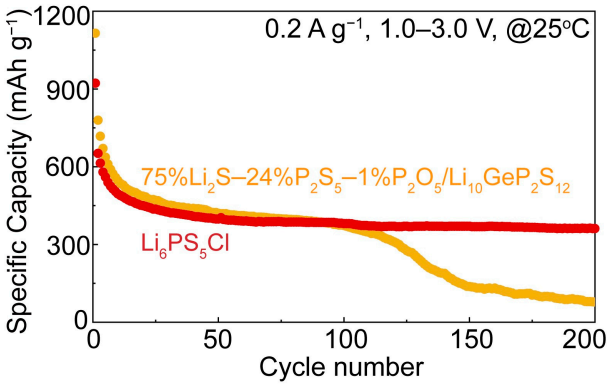

Figure S2. Cyclic performances of Li/Li_6PS_5Cl/MoS_6 and Li/75%Li_2S-24%P_2S_5-1%P_2O_5/$Li_{10}GeP_2S_{12}$/MoS_6 all-solid-state batteries under 0.2 A g^{-1}.

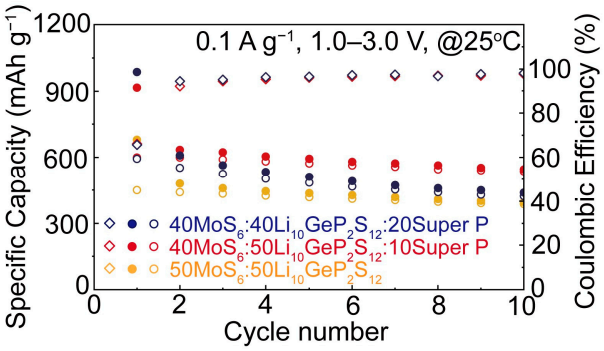

Figure S3. Cyclic performances of all-solid-state batteries with $50MoS_6$:$50Li_{10}GeP_2S_{12}$, $40MoS_6$:$50Li_{10}GeP_2S_{12}$:10Super P and $40MoS_6$:$40Li_{10}GeP_2S_{12}$:20Super P cathodes under 0.1 A g^{-1}.

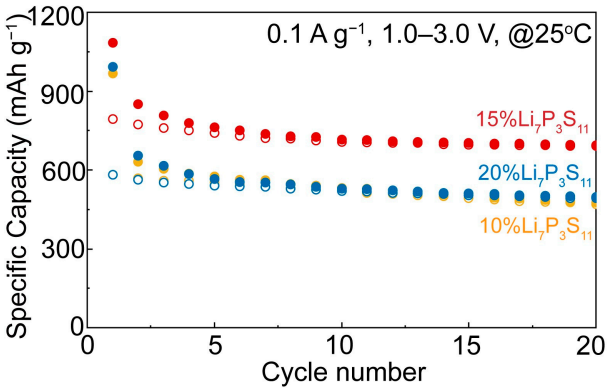

Figure S4. Cyclic performances of MoS_6@10%$Li_7P_3S_{11}$, MoS_6@15%$Li_7P_3S_{11}$ and MoS_6@20%$Li_7P_3S_{11}$ cathodes under 0.1 A g^{-1}.

Table S1. Inductively coupled plasma emission spectrometer analysis of MoS_6.

Elements	S	Mo
Weight %	63.5	31.5
Atom %	85.7	14.2

Table S2. Electrochemical performances comparisons of various active materials in all-solid-state-batteries.

Active Material	Electrolyte	Anode	Voltage Range (V)	Initial Capacity (mAh g^{-1})	Reversible Capacity (mAh g^{-1})	Reference
rGO-MoS_3	$Li_{10}GeP_2S_{12}$/75%Li_2S–24%P_2S_5–1%P_2O_5	Li	0.5–3 V	1241.4	~760	17
Cubic FeS_2	77.5%Li_2S–22.5%P_2S_5	Li	1–3 V	750	~730	10
Co_9S_8@$Li_7P_3S_{11}$	$Li_{10}GeP_2S_{12}$/75%Li_2S–24%P_2S_5–1%P_2O_5	Li	0.5–3 V	633	574	21
MoS_2@$Li_7P_3S_{11}$	$Li_7P_3S_{11}$	Li	0.1–3 V	868.4	669.2	19
MoS_6	Li_6PS_5Cl	Li	1–3 V	913.9	635.1	This work
MoS_6@15%$Li_7P_3S_{11}$	Li_6PS_5Cl	Li	1–3 V	1083.8	851.5	This work

Table S3. EIS fitting results of MoS_6 and MoS_6@15%$Li_7P_3S_{11}$ under 0.1 A g^{-1} after 20 cycles.

Cathode materials	1st cycle		20th cycle	
	R_e (Ω)	R_{ct} (Ω)	R_e (Ω)	R_{ct} (Ω)
MoS_6	105.42	/	384.11	52.96
MoS_6@15%$Li_7P_3S_{11}$	75.89	/	124.79	10.78

Table S4. MoS_6 values used in energy density and power density calculations.

Current density ($A\ g^{-1}$)	Energy density of active materials ($Wh\ kg^{-1}$)	Energy density of cathode layer ($Wh\ kg^{-1}$)	Time duration (h)	Power density ($W\ kg^{-1}$)
0.1	1209.2	495.8	7.07	70.12
0.2	915.2	375.2	2.66	141.1
0.5	706.2	289.5	0.84	344.7
1.0	559.8	229.5	0.34	675.1
2.0	422.4	173.2	0.13	1332.2

Table S5. MoS_6@15%$Li_7P_3S_{11}$ composite values used in energy density and power density calculations.

Current density ($A\ g^{-1}$)	Energy density of active materials ($Wh\ kg^{-1}$)	Energy density of cathode layer ($Wh\ kg^{-1}$)	Time duration (h)	Power density ($W\ kg^{-1}$)
0.1	1434.2	588	8.27	71.1
0.2	1160.7	475.9	3.33	142.9
0.5	944	387	0.84	351.9
1.0	794.7	325.8	0.47	693.2
2.0	629.3	258	0.19	1358