Supplementary Information

Synthesis of Sulfide Solid Electrolytes from Li_2S and P_2S_5 in Anisole

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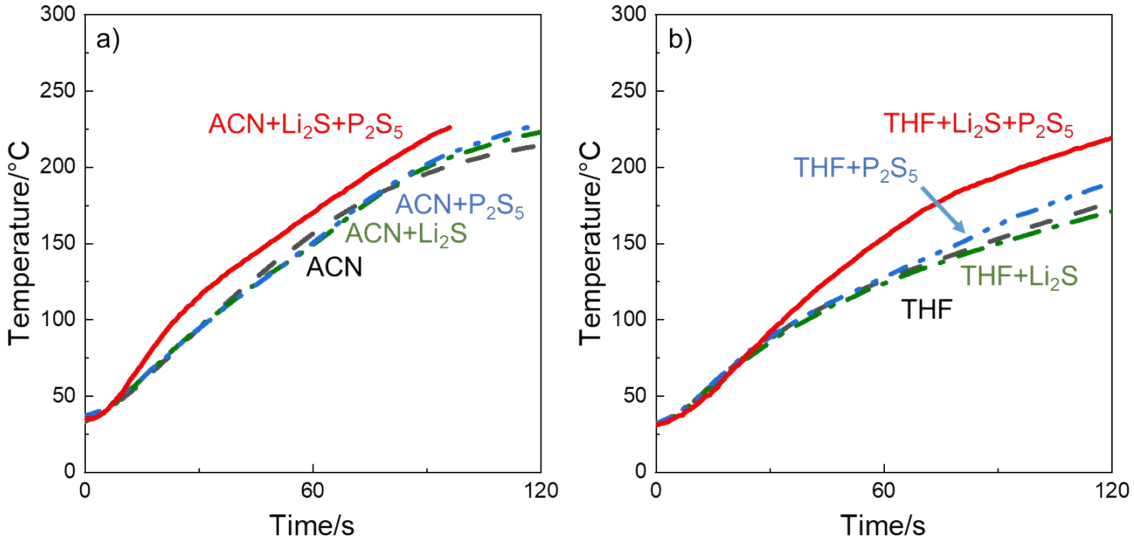

Figure S1. The temperature change during microwave irradiation a) in ACN b) in THF. The output power of microwave was 100 W.

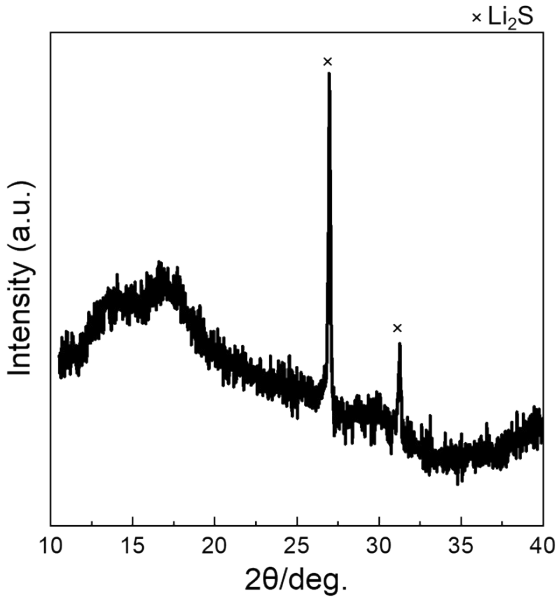

Figure S2. The XRD pattern of the precipitation of suspension (Li_2S:Lawesson's reagents = 75:25) using anisole after microwave irradiation.

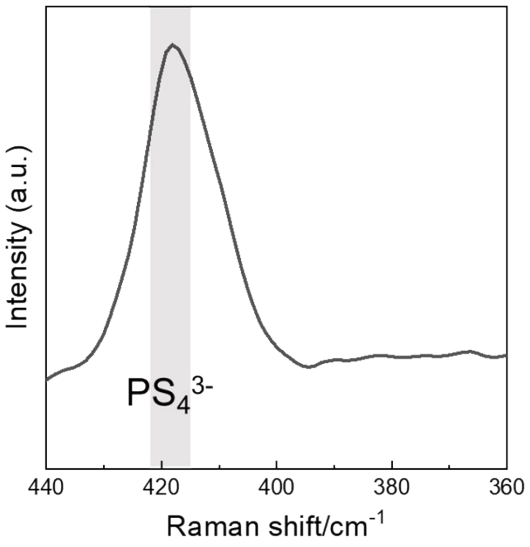

Figure S3. Anisole+Li_2S+P_2S_5 raman spectrum after microwave irradiation used a SiC vial.

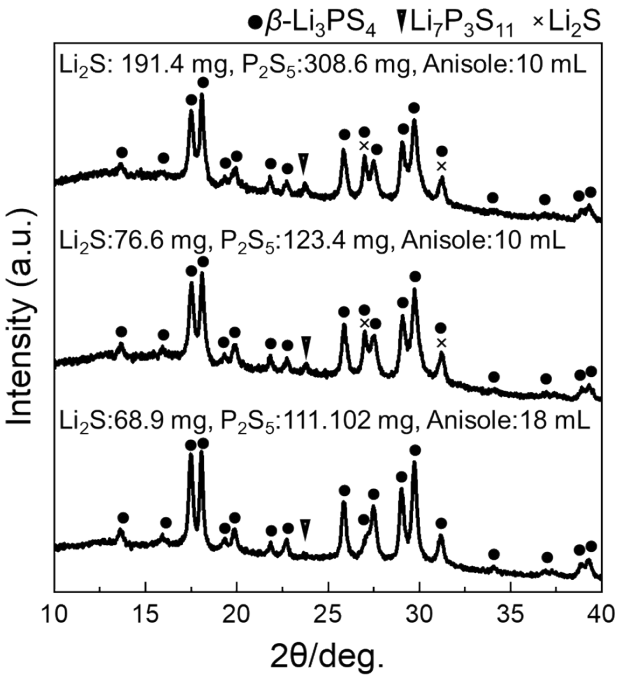

Figure S4. The XRD patterns of the solid electrolytes with varying ratio of reagent to solvent. The ratio of Li_2S to P_2S_5 was fixed at 75:25. Ball-milled Li_2S was used. The microwave irradiation was applied until the temperature reached 220 °C

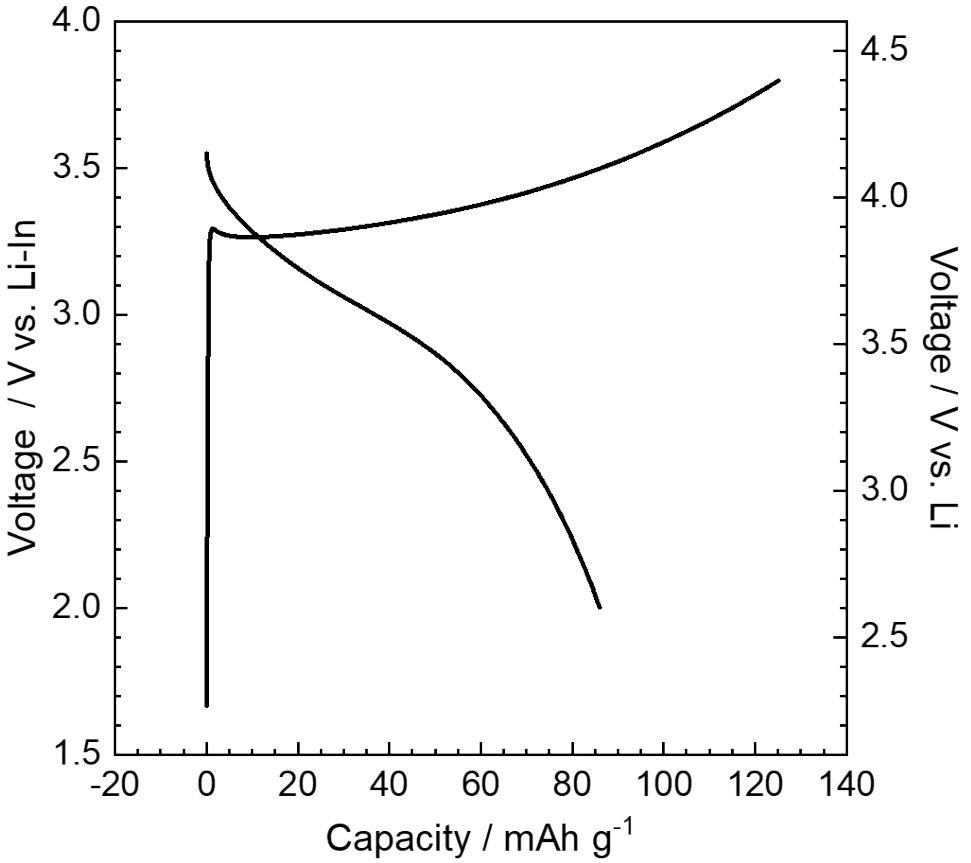

Figure S5 Discharge-charge profile of all-solid-state battery with the cathode composite composed of $Li_7P_3S_{11}$ synthesized using anisole. The ratio of the composite was $LiNbO_3$-coated $LiNi_{1/3}Co_{1/3}Mn_{1/3}O_2$ (NMC): synthesized solid electrolyte: Vapor Grown Carbon Fiber (VGCF) = 69:29:2 (mass %). The battery was fabricated according to the literature [M Calpa, et al., *Electrochimica Acta*, 2019, **219**, 473-480.].

Figure S6. The photo of P_2S_5 and anisole solution after microwave irradiation.

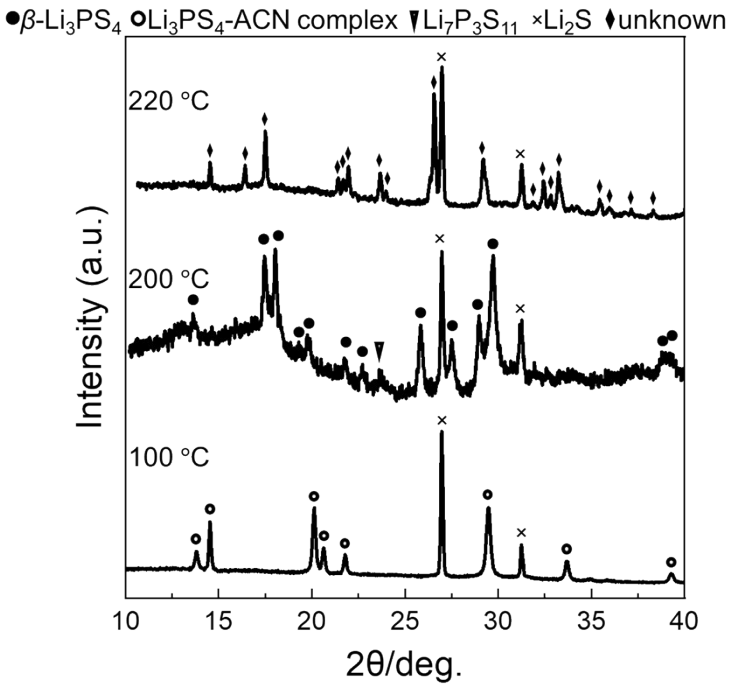

Figure S7. The XRD pattern of the precipitation of suspension (Li_2S:P_2S_5 = 75:25) using ACN after microwave irradiation.

Table S1. Detailed reagent and solvent amounts of Figure 3–5, S2–S4, S6.

Exp. #	Figure #	Li_2S (without ball milling)/mg	Li_2S (with ball milling)/mg	P_2S_5/mg	Lawweson's reagents/mg	LiCl/mg	Anisole/mL	ACN/mL	Microwave heating/°C	Post heating/°C
1	3	68.9	-	111.1	-	-	18	-	100	-
2	3	68.9	-	111.1	-	-	18	-	180	-
3	3	68.9	-	111.1	-	-	18	-	200	-
4	3	68.9	-	111.1	-	-	18	-	220	-
5	3	68.9	-	111.1	-	-	18	-	240	-
6	3	68.9	-	111.1	-	-	18	-	260	-
7	3	68.9	-	111.1	-	-	18	-	280	-
8	3	68.9	-	111.1	-	-	18	-	300	-
9	4	58.6	-	121.4	-	-	18	-	260	-
10	5	68.9	-	111.1	-	-	18	-	220	200
11	5	-	68.9	111.1	-	-	18	-	220	200
12	5	58.6	-	121.4	-	-	18	-	260	300
13	5	85.6	-	82.8	-	31.6	14	-	220	180
14	5	85.6	-	82.8	-	31.6	14	-	220	550
15	S2	25.6	-	-	74.6	-	18	-	300	-
16	S3	23.0	-	37.0	-	-	6	-	260	-
17	S4	-	68.9	111.1	-	-	18	-	220	200
18	S4	-	76.6	123.4	-	-	10	-	220	200
19	S4	-	191.4	308.6	-	-	10	-	220	200
20	S6	137.8	-	222.2	-	-	-	18	100	-
21	S6	137.8	-	222.2	-	-	-	18	200	-
22	S6	137.8	-	222.2	-	-	-	18	220	-