



Supporting Information

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Fast Lithium Ion Conduction in Garnet-type $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ **

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Table S1 Indexed powder XRD pattern of garnet-type $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$

h	k	l	$d_{\text{obs.}}(\text{\AA})$	$d_{\text{cal.}}(\text{\AA})$	I_{obs}
2	1	1	5.278	5.294	99
2	2	0	4.574	4.584	17
3	2	1	3.460	3.465	55
4	0	0	3.239	3.242	42
4	2	0	2.897	2.899	100
3	3	2	2.761	2.764	14
4	2	2	2.645	2.647	61
5	2	1	2.365	2.367	49
5	3	2	2.102	2.103	37
6	2	0	2.048	2.050	11
6	3	1	1.911	1.912	16
4	4	4	1.870	1.871	12
6	4	0	1.798	1.798	21
6	3	3	1.764	1.764	20
6	4	2	1.732	1.732	93
7	3	2	1.646	1.646	15
8	0	0	1.620	1.621	14
6	5	3	1.549	1.550	13
7	5	2	1.468	1.468	9
8	4	0	1.450	1.449	11
8	4	2	1.415	1.414	17
9	2	1	1.398	1.398	14
6	6	4	1.382	1.382	14
9	3	2	1.337	1.337	24
7	7	2	1.283	1.284	10
7	6	5	1.236	1.236	11
8	6	4	1.204	1.204	21
10	4	2	1.184	1.183	14
10	5	1	1.155	1.155	13
8	8	0	1.146	1.146	10
10	5	3	1.120	1.120	10

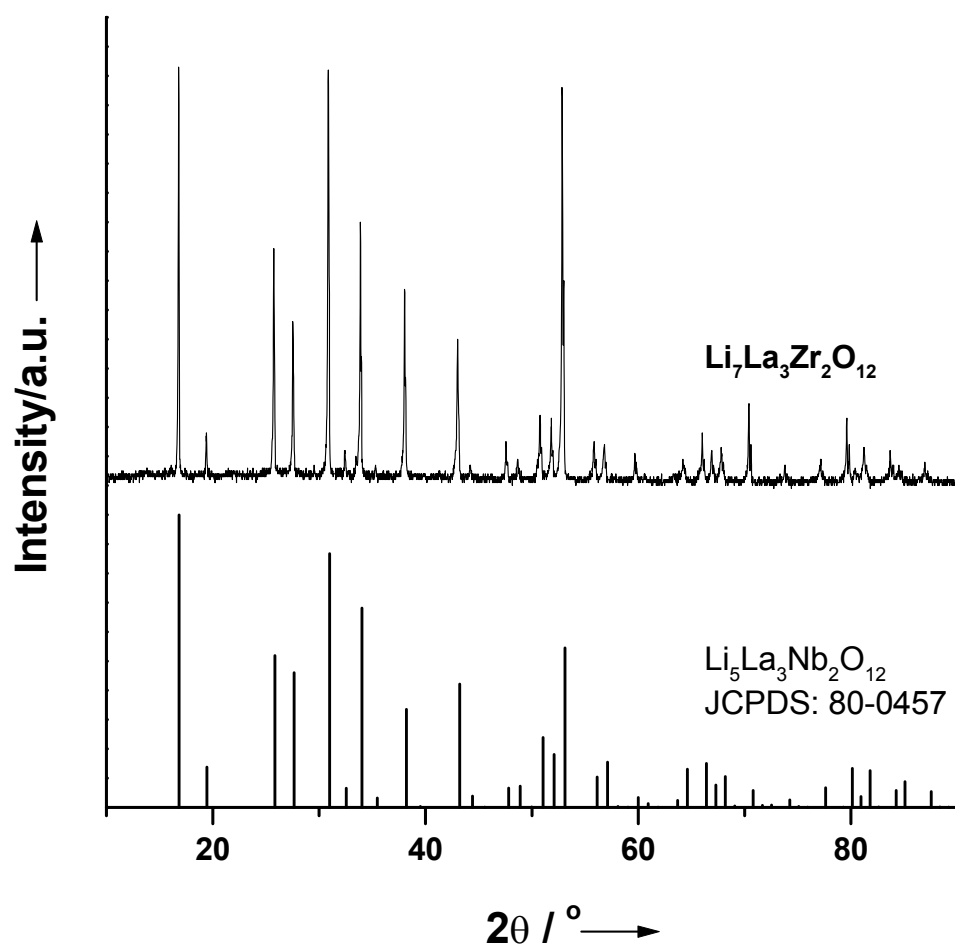


Figure S1. Measured powder XRD pattern of $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ together with the standard pattern of the known garnet phase $\text{Li}_5\text{La}_3\text{Nb}_2\text{O}_{12}$ (JCPDS: 80-0457) reported in Joint Committee on Powder Diffraction Standards.

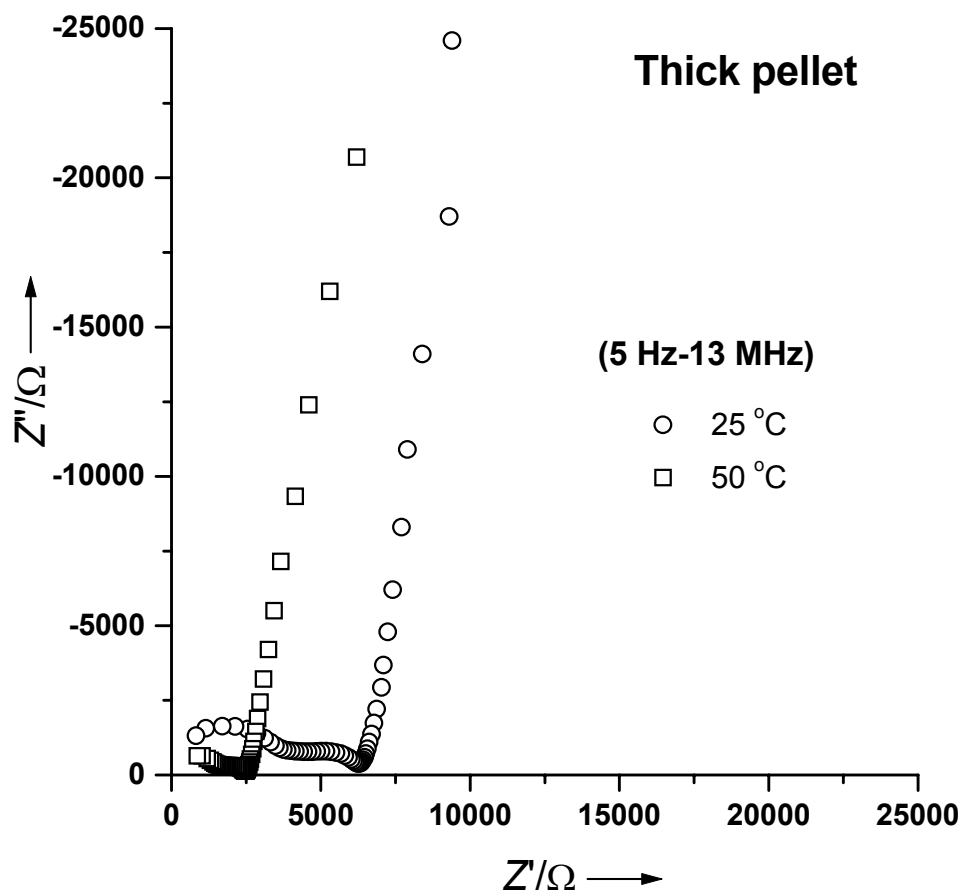


Figure S2. Ac impedance plots measured in air at 25 and 50 °C for the thick pellet of $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$.

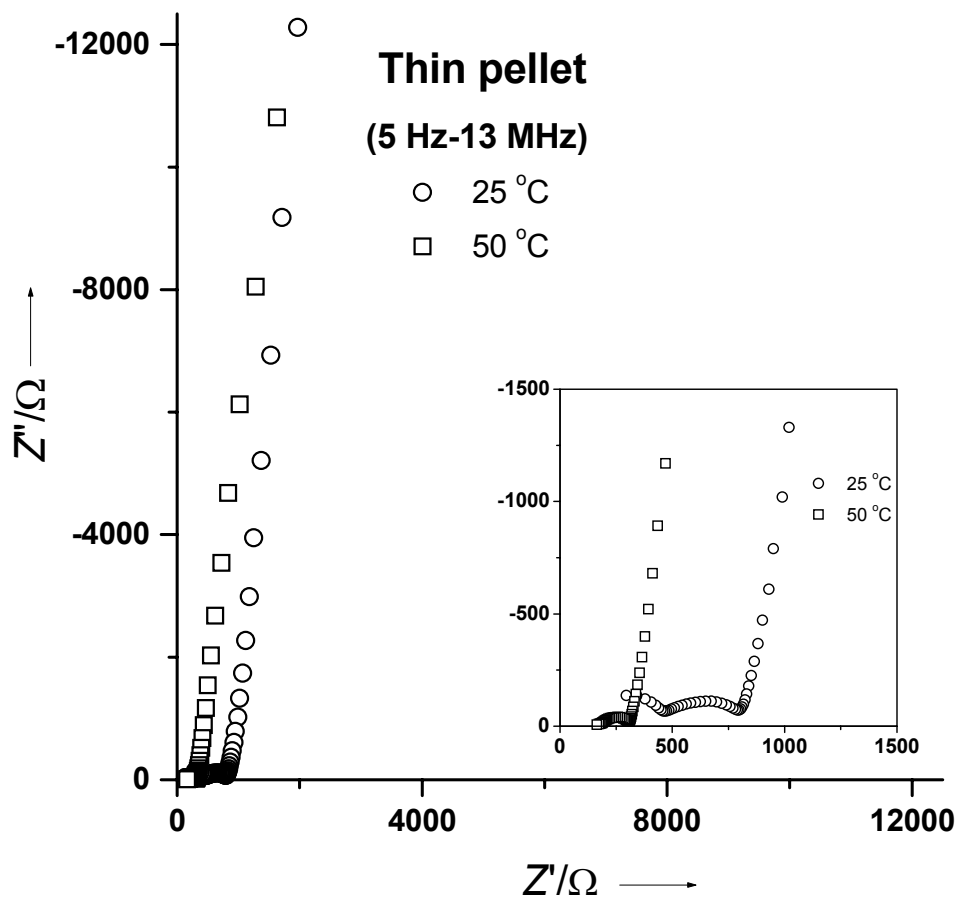


Figure S3. Ac impedance plots measured in air at 25 and 50 °C for the thin pellet of $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$. The expanded impedance plots at high frequencies are shown as inset.

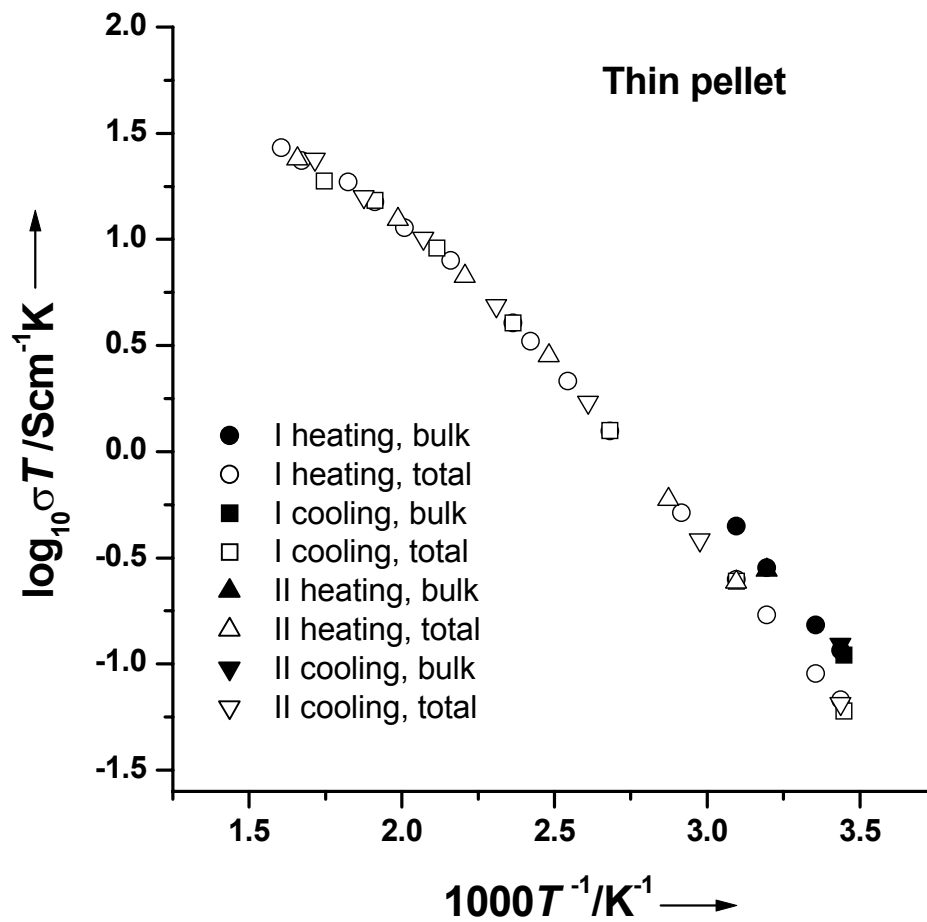


Figure S4. Arrhenius plots for the bulk and total (bulk + grain-boundary) electrical conductivity of the thin pellet of $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ obtained in two heating and cooling cycles consecutively.

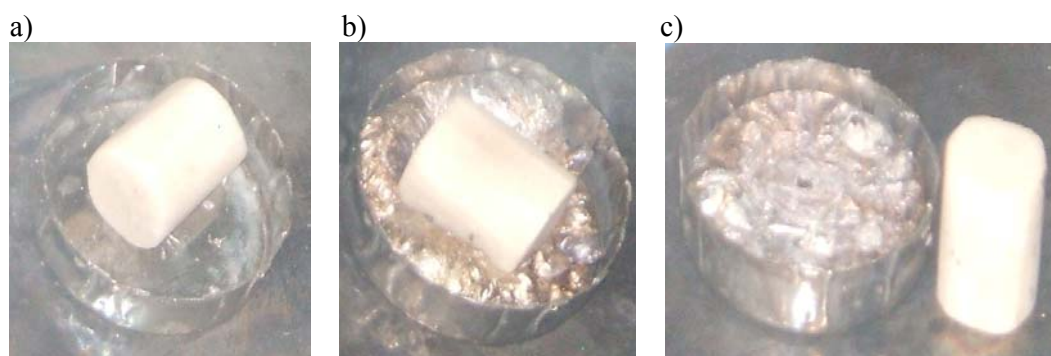


Figure S5. Photograph of a) $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ pellet and molybdenum crucible just before the reaction with molten lithium b) $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ pellet in molten lithium and c) $\text{Li}_7\text{La}_3\text{Zr}_2\text{O}_{12}$ pellet and molybdenum crucible just after the exposure to molten lithium for 48 h. The photograph shown in Figure c) indicates that the colour of the pellet remains the same original one (ivory), and no reaction product was found.