Electronic Supplementary Material (ESI) for Journal of Materials Chemistry A

Supporting Information

A High Conducting Oxide – Sulfide Composite Lithium Superionic Conductor

*Ezhiylmurugan Rangasamy, Gayatri Sahu, Jong Kahk Keum, Adam J. Rondinone, Nancy J. Dudney and Chengdu Liang **

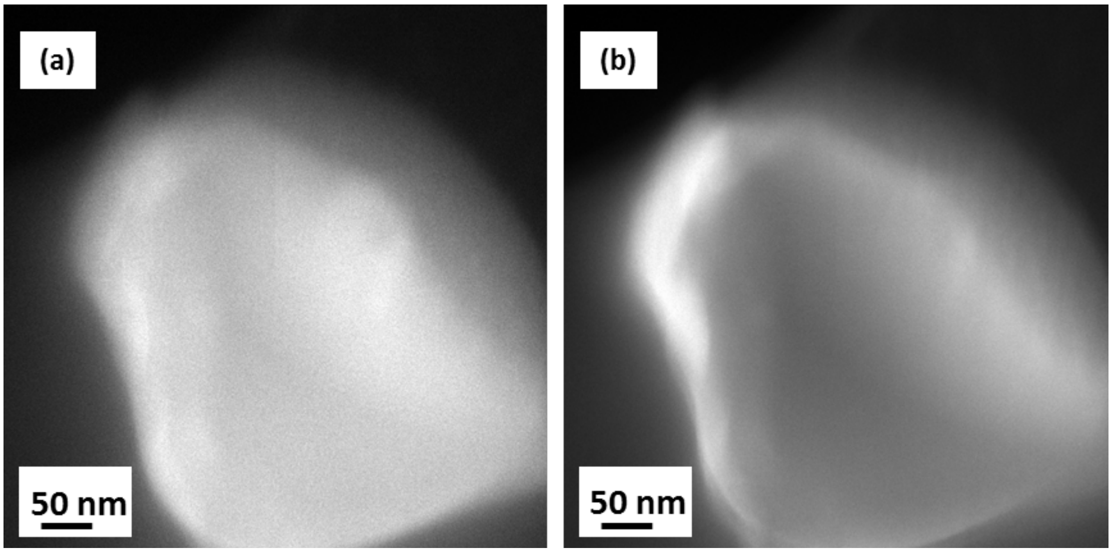

Figure S1: EELS map of the composite electrolyte illustrating the (a) Zr and (b) La distribution. From the images it is evident that the core is made up of LLZO while there is no presence of La and Zr in the shell, further confirming that it is a LLZO core – LPS shell structured composite electrolyte.

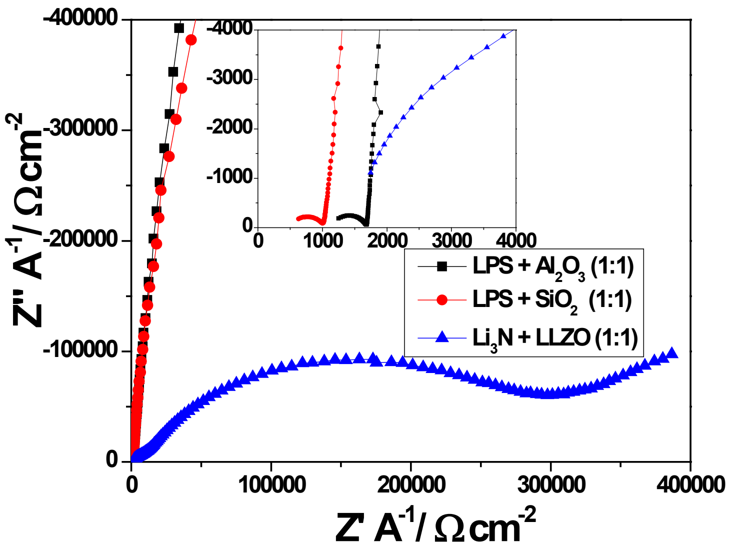

Figure S2: Room temperature data for some of the composite combinations (1:1 wt. ratio) attempted with LPS and LLZO systems. The conductivities of the composites are calculated to be: LPS-Al_2O_3 = 2.89×10^{-5} S cm^{-1}, LPS-SiO_2 = 4.09×10^{-5} S cm^{-1} and Li_3N-LLZO = 2.0×10^{-7} S cm^{-1}. The resulting multi-fold decrease in conductivity clearly suggests that LPS and LLZO have a unique relationship with each other that leads to the observed enhancement in conductivity.

Sample (Wt. Fraction of LPS - %)	**Relative Density (%)**
0	61.1
10	70.3
30	73.0
40	74.4
60	75.8
65	77.2
70	78.4
75	80.3
80	83.6
90	90.1
100	96.2

Table S1: Relative density variations as a function of the LPS concentration clearly reveal the improvement in room temperature processability of the LLZO. The relative density values also indicate that there is scope for improvement in the ionic conductivity of the 70:30 (LPS:LLZO) sample with improved membrane fabrication.