Solution Based Synthesis and Characterization of Lithium-ion Conducting Phosphate Ceramics for Lithium Metal Batteries

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ABSTRACT: High conductivity solid electrolytes are promising solutions for extremely high energy density battery systems including Li/Air and Li/Sulfur. Lithium aluminum titanium phosphate (LATP) ceramics have among the highest reported ionic conductivities and are promising candidates as solid electrolytes. Li$_{1.3}$Al$_{0.3}$Ti$_{1.7}$(PO$_4$)$_3$ powders were synthesized, for the first time via a solution based method at synthesis temperatures as low as 650°C. The ceramic powders are characterized using X-ray powder diffraction, solid state magic angle spinning (MAS) nuclear magnetic resonance (NMR), scanning electron microscopy (SEM) and thermogravimetric analysis (TGA). The effect of Li and Al local structure and the presence of amorphous and crystalline impurities on electrolyte morphology and sinterability have been studied in detail.

Supporting Information

Figure S1. $^{27}$Al MAS NMR of LATP powder synthesized using all solid state synthesis at 750°C

Figure S2. $^7$Li MAS NMR of LATP powder synthesized using all solid state synthesis at 750°C

Figure S3. $^{31}$P MAS NMR of LATP powder synthesized using all solid state synthesis at 750°C

Figure S4. XRD pattern of the LATP precursor