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Bismuth Aliovalent Substitution in LiLaZrO Garnets DEREK K SCHWANZ, School of Materials Engineering, Purdue University, USA., ERNESTO E. MARINERO, Schools of Materials and Electrical and Computer Engineering, Purdue University, USA. — We report on the synthesis of cubic-phase solid-state electrolytes based on Li7La3Zr2O12 (LLZO). Ionic conductivities up to 1.2 x 10-4 S/cm are readily achieved. Moreover, these results are accomplished at unprecedented low synthesis temperatures. Bismuth aliovalent substitution into LLZO utilizing the Pechini method processing is successfully employed to synthesize Li7-xLa3Zr2-xBixO12 compounds. Cubic phase Li6La3ZrBiO12 powders are generated in the temperature range from 650 C to 900 C in air. In contrast, in the absence of Bi and under identical synthesis conditions, the cubic garnet phase is not formed below 700 C, in addition, at 900 C the un-doped compounds are observed to transform to the tetragonal phase. The critical role of Bi in lowering the formation temperature of the garnet cubic phase and the improvements in ionic conductivity are elucidated in this work through microstructural and impedance measurements, correlating stoichiometry variations to both improved intergranular degree of sintering and ionic conductivity. We ascribe the effect of Bi doping in achieving these remarkable improvements to significant enhancements in grain growth and densification. In addition Bi optimizes the Li+ occupancy resulting in increased ionic conductivity.

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