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Composite Polymer-Garnet Solid State Electrolytes ANDRES VILLA, MUHAMMED R. ODUNCU, GREGORY D. SCOFIELD, ERNESTO E. MARINERO, School of Materials Engineering, Purdue University, USA, SCOTT FORBEY, Battery Innovation Center, Newberry, Indiana, USA — Solid-state electrolytes provide a potential solution to the safety and reliability issues of Li-ion batteries. We have synthesized cubic-phase Li7-xLa3Zr2-xBixO12 compounds utilizing inexpensive, scalable Sol-gel synthesis and obtained ionic conductivities 1.2 x 10-4 S/cm at RT in not-fully densified pellets. In this work we report on the fabrication of composite polymer-garnet ceramic particle electrolytes to produce flexible membranes that can be integrated with standard battery electrodes without the need for a separator. As a first step we incorporated the ceramic particles into polyethylene oxide polymers (PEO) to form flexible membranes. Early results are encouraging yielding ionic conductivity values 1.0 x 10-5 S/cm at RT. To increment the conductivity in the membranes, we are optimizing amongst other: the ceramic particle size distribution and weight load, the polymer molecular weight and chemical composition and the solvated Li-salt composition and content. Unhindered ion transport across interfaces between the composites and the battery electrode materials is paramount for battery performance. To this end, we are investigating the effect of interface morphology, its atomic composition and exploring novel electrode structures that facilitate ionic transport.

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