Improving the High Conductivity and safety of the Polymer electrolyte for Solid State Lithium ion battery

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Solid state electrolyte (SSE) could improve both safety and energy density for use in transportation application to replace commercial organic liquid electrolytes potentially. However, organic polymer SSEs show the disadvantages within low ion conductivity, < 10^{-5} S/cm, and easy flammability. Therefore, the high conductivity and the safety of organic SSE was developed from modified the commercial electrolyte by adding reactive oligomer additive and the initiator in Fig 1. The electrolyte film within good mechanical property and flexibility was made by polymerization to improve safety. This is a novel qausi-solid state electrolyte (QSSE) to provide the liquid state and inject into the battery easily before gelation process. The QSSE showed the high conductivity 1.3*10^{-4} S/cm at 30 ℃. The fabricated LNMO/LTO battery within 15um thickness of the QSSE can achieve good rate capability at room temperature successfully without the separator in Fig 2. The QSSE was developed to form the thin film compacted well between the cathode and the anode without surface resistance issue. It has many advantages containing good mechanical property, high conductivity, low cost, safety, and easily battery manufacture. The QSSE also acts polymer binder material to blend with ceramic electrolyte, and form organic/inorganic composite electrolyte to solve surface resistance issue of solid state battery.

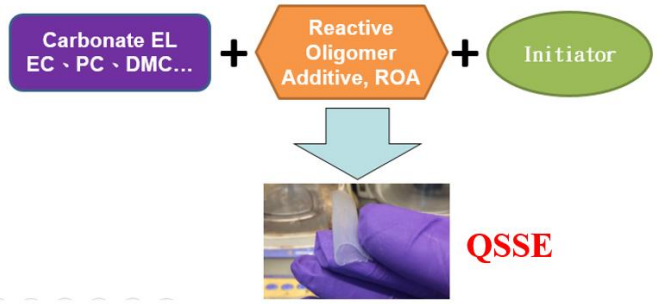

Fig 1. The strategy and the composition of qausi-solid state electrolyte (QSSE) for high conductivity and safety.

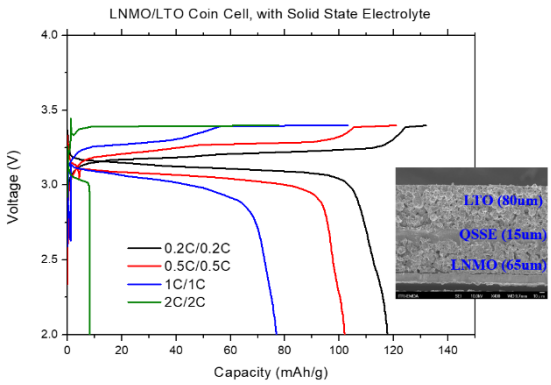

Fig 2. The QSSE evaluation for rate capability at 25℃, and cross-section morphology of LNMO/LTO cell.

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