

Free-Standing Ion-Conductive Gels with Bicontinuous Transfer Channels as Solid Electrolytes for Lithium-Ion Batteries

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Solid polymer electrolyte is alternative electrolyte for replacing traditional liquid electrolyte in Li-ion battery. Its explosion and leaking problems make a battery issue. However, solid polymer electrolyte still has a quite low ion conductivity. Here, we report the self assembled Nano-structure based bicontinuous solid polymer electrolyte. Surfactant, ionic liquid and oil crosslinker make a long-term stable ternary water-free microemulsion. After crosslinking by photo initiator, obtained a free standing ion gels. SAXS analyzing shows a bicontinuous Nano-structure shape and nano-scale ion channel size and exhibits high ion conductivity and lithium transference number [ $t_+$ ] (1.4mS/cm,  $t_+ = 0.56$  at room temperature). Also, half cell assembled with LFP (LiFePO<sub>4</sub>) exhibits good cycle capacity retention( 94% after 100 cycles). Bicontinuous structure demonstrates that ion channel can accelates Li ion mobility and crosslinking domain for free-standing.