Improvement of solid polymer electrolyte in low temperature lithium metal polymer batteries

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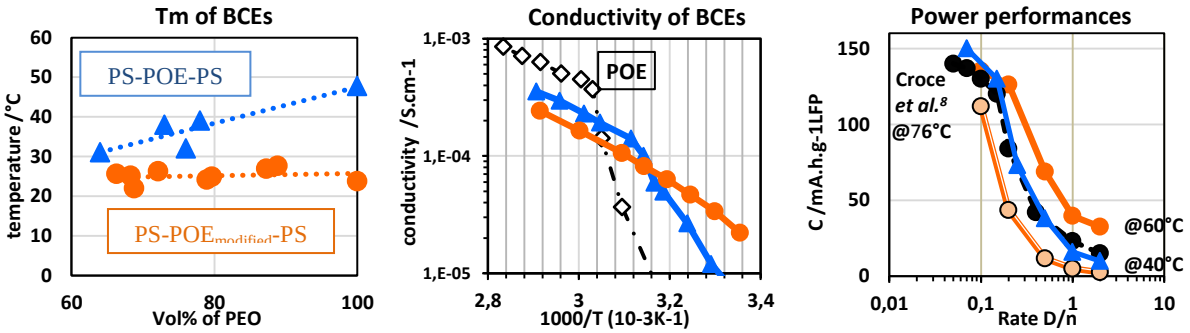
Nowadays, lithium-based batteries are widely used in electronic devices due to the Li-ion technology, and they are increasingly used in (hybrid) electric vehicles [1]. One major issue towards large-scale application concerns their safety, due to the volatility, flammability and low flash point of solvents used as electrolytes. With regard to the safety concerns, solvent free membranes are very attractive for solid polymer electrolytes (SPE) in particular, complexes of polyethyleneoxide (PEO) and lithium salt that is the most exploited polymer electrolyte system. PEO has been chosen for its outstanding ability to solvate lithium cation. However because of its high crystallinity, the ion conduction of this SPE is significantly lower than in liquid one. Better conductivities are provided by this complex above the PEO melting temperature, but at these temperatures the mechanical properties are very poor and dendrites formation was observed [2].

In order to combine, in a same material, the two antagonistic properties, i.e. high conductivity and good mechanical strength, block copolymer electrolytes (BCE) have recently been proposed as SPE [3-7]. The high performance of these functional materials is a consequence of their ability to self-assembly resulting to phase separated nanostructure and thus to a synergy of properties instead of average ones.

In this work we have designed a new BCE with a central block based on modified PEO, that is much more amorphous compared to linear PEO, and two lateral blocks of polystyrene.



The proprieties of BCE were modulated by varying the lengths of PS. The impact of the ration between the two blocks on the mechanical strength, conductivity and lithium metal cell performances are deeply discussed in this work.

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