Synthesis and characterization of new single ion electrolytes for lithium metal polymer batteries

Adrien Lassagne[a,b], Renaud Bouchet[a,b], Cristina Iojoiu[a,b]
[a] *Université Grenoble Alpes, LEPMI, F-38000 Grenoble, France*
[b] *CNRS, LEPMI, F-38000 Grenoble, France*
Email address of the presenting author: adrien.lassagne@lepmi.grenoble-inp.fr

Due to their great success for portable electronic devices, lithium-based batteries are becoming increasingly important for (hybrid) electric vehicles[1]. One major issue towards large-scale applications concerns their safety.
The use of a solid polymer electrolyte (SPE), which is commonly a lithium salt associated with a polyethylene oxide (PEO) without organic solvents, could solve most of the safety issues encountered with liquid electrolytes. However, the development of SPE has been hampered by two hurdles: i) the inability to design a SPE with both: high ionic conductivity and good mechanical properties and ii) the low cationic transport number[2], which leads during battery operation to the formation of a strong concentration gradient with deleterious effects which favored dendritic growth[3] and limited power delivery.

In order to combine, in a same material, the two antagonistic properties (mechanical and conductivity), block copolymer electrolytes (BCE) have recently been proposed as SPE[4–8]. The interesting properties of these functional materials is a consequence of their self-assembly properties, which give rise to ordered structures and permits an addition of properties instead of average ones.
Recently, Bouchet et al.[9] synthetized triblock copolymers based on polystyrene bearing trifluoromethansulfonimide (PSSI) and PEO (PSSI-PEO-PSSI) and obtained a single-ion conductivity of 1.3 10^{-5} $S.cm^{-1}$ at 60° C.
In order to improve the electrolyte performances we synthesised new BCE in which the nature of anion was varied. The impact of anion nature, lengths of blocks, elaboration method on the mechanical strength, conductivity, cationic transference number and lithium metal cell performances are largely discussed in this work.

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