SYNTHESIS OF NEW SINGLE-ION COPOLYMER ELECTROLYTES FOR LITHIUM-METAL BATTERIES

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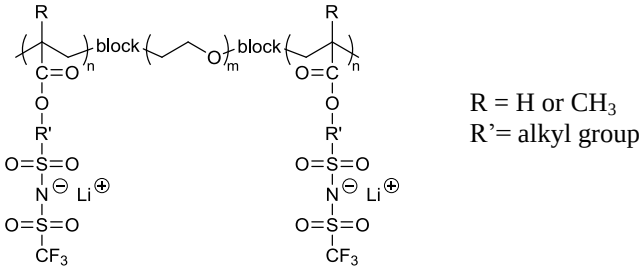
Alternative mode of transportation such as fully-electric or hybrid vehicles are a matter of primary importance for a sustainable long-term development. In line with this societal context, the elaboration of cheap and safe batteries with high specific energy suitable for the mass-market of electric vehicles has been stimulating the scientific community for many years. Among different battery technologies, Lithium-Metal Batteries are very well-positioned[1] thanks to the high energy density of lithium. However, this technology presents several issues such as the use of liquid-based electrolytes that can lead to undesired leaks. But, the main concern of this technology is related to a possible lithium dendritic growth during charge/discharge cycles causing internal short-circuits possibly followed by dramatic explosion and fire. To overcome these drawbacks, solid polymer electrolytes (SPE) combining both high conductivity and suitable mechanical properties to prevent dendritic growth are perfect candidates. Recently, we demonstrated the remarkable potential of multifunctional single-ion block copolymers based on polystyrene derivatives and poly(ethylene oxide) as SPE for Lithium-Metal battery technology.[2-3] In order to constantly improve the SPE properties and to get a better insight of their mode of action, we present in this study the synthesis of new series of single-ion copolymer electrolytes based on anionic poly(meth)acrylate derivatives. (Fig.1)



R = H or CH_3
R'= alkyl group

Fig.1: Structure of single-ion block copolymer electrolyte

Various block copolymers with different compositions were synthesised using the Nitroxide-Mediated Polymerization technique. Their performance as SPE for ionic conduction was evaluated by electrochemical impedance spectroscopy.

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[3] R. Bouchet, T.N.T. Phan, E. Beaudoin, D. Devaux, P. Davidson, D. Bertin, R. Denoyel, Macromolecules. 47 (2014) 2659-2665.