

Crosslinked PMMA Gel Electrolytes for Li-ion Battery

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Today, mainly poly(vinylene difluoride-hexafluoropropylene) (PVDF-HFP)-based gels electrolytes are used in Li-ion ('LiPo') batteries. Here, poly(methyl methacrylate) (PMMA) was chosen for developing gel electrolytes as it is cheap, non-toxic, and can easily form gels, even in its linear form. Moreover, MMA-derived monomers can be used to form various functionalized and cross-linked polymers, allowing great versatility in terms of liquid fraction intake and mechanical properties.

Gel electrolytes were prepared in one-step radical polymerization from a solution including the liquid electrolyte fraction with additives, MMA, crosslinkers. Lithium bis(trifluoromethanesulfonyl)imide (LiTFSI) is used as main lithium salt, as it is stable at high temperature and insensitive to hydrolysis, which facilitates its recycling. Moreover, to ensure high safety at elevated temperature, no linear alkyl carbonates are used. The electrolytes have been characterized in terms of physico-chemical and electrochemical properties (DSC, TGA, cyclic voltammetry, IR, impedance spectrometry, constant current cycling) for a use in state-of-the-art Li-ion battery cells. High efficiencies and stable cycling was reached with graphite/LiMn_{0.33}Ni_{0.33}Co_{0.33}O₂ cells, as shown in figure 1, with stable cycling for more than 100 cycles.

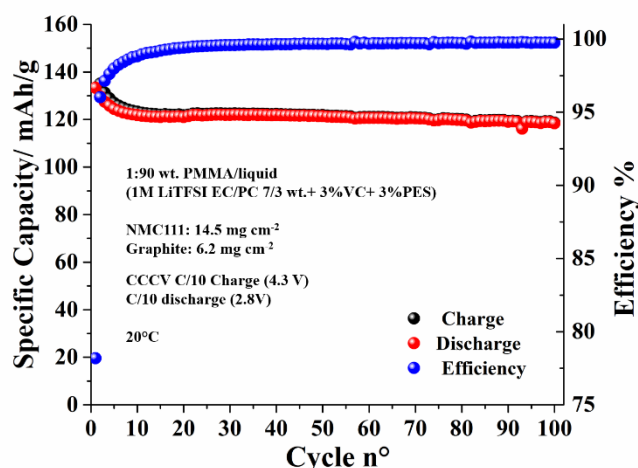


Figure 1 : Cycling performance of graphite/NMC Li-ion battery including a PMMA, in-situ crosslinked electrolyte and a EC/PC based electrolyte with 1,3-propene sultone (PES) and vinylene carbonate (VC) as additive.

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