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Crystallinity and phase separation in nanocomposite copolymer electrolytes for Lithium batteries

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Long scale transition to green energy and wide penetration of electric cars, demand for batteries with high power density, and good mechanical stability. The electrolyte is of crucial importance for both. Poly(ethylene oxide) (PEO), although very reliable, has two drawbacks: 1) poor mechanical stability 2) crystallinity, acting as barrier to the ion mobility. Mechanical stability may be provided by copolymerization with polystyrene (PS) and introduction of nanoparticles, which in addition are known to suppress crystallinity. We blended silica nanoparticles into an electrolyte consisting of a PS-PEO diblock copolymer and LiTFSI salt. In this first stage of our work we study by X-ray scattering and DSC the effects of nanoparticles on phase separation and crystallinity: a salt loading of molar ratio Li:EO = 0.1 already eliminates PEO crystallinity, and a moderate loading of nanoparticles (~1wt%) enhances the thickness of the PEO lamellae, which may lead to increased conductivity.

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