ABSTRACT

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Towards Solid Batteries Operating at Ambient Temperature Exploiting Highly-Crosslinked (Composite) PEO-based Polymer Electrolytes.

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Profoundly ion conducting, self-standing and tack-free ethylene oxide based polymer electrolytes are successfully prepared via a rapid and easily up-scalable free radical polymerization (UV/thermal curing). It can be an interesting alternative to produce polymer electrolytes, being highly advantageous due to its easiness and rapidity in processing, high efficiency and eco-friendliness as the use of solvent is avoided.
The crosslinking produced during curing allows the incorporation of high amount of RTIL (e.g., imidazolium, pyrrolidinium) or tetraglyme and lithium salt ($TFSI^{-}$ anion), leading to a material with remarkable homogeneity and robustness. The polymer network can efficiently hold plasticizers without leakage. Samples are thermally stable up to 375 °C under inert conditions, which is particularly interesting for application in Li-ion batteries with increased safety. Excellent ionic conductivity (>0.1 mS cm^{-1} at 25 °C), wide electrochemical stability (> 5 V vs. Li), stable interfacial properties and dendrite nucleation/growth resistance are obtained. The lab-scale Li-polymer cells assembled with different electrode materials (e.g., $LiFePO_4$, Li-rich NMC, $LiCoPO_4$, TiO_2) show stable charge/discharge characteristics with limited capacity fading upon very long-term reversible cycling [1-3]. More recently, efforts are dedicated to the formulation of composite hybrid polymer electrolytes that, compared to the pristine components, are stiff while preserving flexibility and can be conceived to attain improved transport properties and interfacial stability.
The overall remarkable performance of the novel polymer electrolytes postulates the possibility of effective implementation in the next generation of safe and durable secondary Li-based polymer batteries working at ambient and/or sub-ambient temperatures.

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