Polymer composites of micro-structured $Li_2Ni_2TeO_6$ as separator for all solid-state lithium battery

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Abstract

Solid-state lithium batteries have been desirably required intensive research for achieving fast developing in industry. Nevertheless, all solid-state lithium batteries have common issue of drawback, which are high interfacial resistance and lower ionic conduction during the charge and discharge processes. Among them, PEO-based electrolyte has high degree of crystallization, which exhibits very low ionic conductivity (10^{-6}–10^{-8} Scm^{-1}) at room temperature. To overcome this drawback, numerous efforts have been devoted to reducing crystallization of PEO by doping foreign filler. Herein, micro-structured $Li_2Ni_2TeO_6$ (LNTO) is blended with Poly (ethylene oxide) (PEO) to fabricate composite solid-state polymer electrolyte (SPE) membranes. The solid-state polymer electrolyte membranes present a maximum ionic conductivity of 4.9 x 10^{-4} Scm^{-1} when blending $Li_2Ni_2TeO_6$ (8 wt%) at 75 ℃. Additionally, the performance of $LiFePO_4$ half-cell with solid-state polymer electrolyte membranes exhibits a good cycling under 75 ℃. It is expected that the new separator with stable electrochemical performance is the potential candidate for batteries that can work effectively in all-solid-state lithium battery.