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Stable cycling of lithium metal electrode in nanocomposite solid polymer electrolytes with lithium *bis*(fluorosulfonyl)imide

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Abstract

Nanocomposite solid polymer electrolytes (NSPEs) comprising lithium salt based on two representative sulfonylimide anions (i.e., *bis*(fluorosulfonyl)imide ($[N(SO_2F)_2]^-$, FSI^-) and *bis*(trifluoromethanesulfonyl)imide ($[N(SO_2CF_3)_2]^-$, $TFSI^-$)) have been prepared by simply dissolving the corresponding lithium salt in poly(ethylene oxide) matrix in the presence of inert nano-sized Al_2O_3 fillers. The physicochemical and electrochemical properties of the FSI- and TFSI-based NSPEs are investigated, in terms of phase transition, ion transport behavior, chemical and electrochemical compatibility with Li metal. With the addition of nano-sized Al_2O_3 fillers, a significant improvement in chemical and electrochemical compatibility with Li metal has been observed in both the FSI- and TFSI-based NSPEs. Particularly, the symmetric cell using the FSI-based NSPE can be continuously cycled for > 1000 h at 70 °C. The Li | $LiFePO_4$ cell with the FSI-based NSPEs shows good cycling stability and capacity retention. These promising results make them attractive electrolytes for safe and stable rechargeable Li metal batteries.