Enhanced Cycling Stability of Lithium Metal Batteries Based on Carbonate-solvent-based Electrolytes at Elevated Temperature

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Abstract:
With the continuous upsurge in demand for energy storage, batteries are increasingly required to operate under extreme environmental conditions. Batteries using lithium (Li) metal as anodes are considered promising energy storage systems because of their high energy densities. However, safety concerns associated with dendrite growth along with limited cycle life, hinder their practical uses. Here we report that an optimal LiTFSI–LiODFB dual-salt/carbonate-solvent-based electrolyte significantly enhances the charging capability and cycling stability of Li metal batteries, at extreme temperature up to 80^{o}C. At the charging current density of 1.3 mA cm^{-2}, the Li||$LiCoO_2$ cells with a high cathode loading of 2.5 mAh cm^{-2} using the electrolyte can deliver an capacity retention of 90% after 100 cycles at 80 ^{o}C. Besides, Li||Li symmetrical cells also show stable cycling up to 400 h at 0.5 mA cm^{-2}. The enhanced stable cycling performances at extreme temperature are ascribed to the generation of a robust and conductive organic-inorganic composite solid electrolyte interphase at the Li metal surface.

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