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Effect of Diethylenetriamine as Additive to Stabilize the Lithium Metal Anode

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Abstract

Li metal has been regarded as the most promising anode material for next high-energy batteries. However, the dendrite growth during the lithium deposition and low Coulombic efficiencies have restricted their practical applications. In the paper, we investigate the electrodeposition process of lithium metal under different current density in detail and firstly use diethylenetriamine as additive to adjust the deposition of lithium metal in $LiPF_6$-PC and $LiPF_6$-EC/DEC electrolyte. The result shows that trace diethylenetriamine can react with lithium anode producing R-N-Li and LiF, which greatly improves the morphology of lithium deposition by adjusting the components of the SEI film. The content of fast ionic conductors in SEI film (e.g., R-N-Li and LiF) can be identified by the X-ray photoelectron spectroscopy. The electrochemical impedance spectroscopy confirms diethylenetriamine could increase the ionic conductivity of the interface between the anode and electrolyte. Galvanostatic curves also show that the $LiPF_6$-PC electrolyte with 0.2 vol% diethylenetriamine and $LiPF_6$-EC/DEC electrolyte with 0.1 vol% diethylenetriamine has better cycling stability than blank group.

Keywords: dendrite; lithium metal anode; additive; SEI film;

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