Understanding the Role of Nano-Aluminum Oxide in All-Solid-State Li-S cells


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Abstract

Aluminum oxide (Al2O3) is a well-known electrolyte filler for stabilizing Li-metal (Li°) anode in all-solid-state Li°-based batteries. However, its strong interaction with lithium polysulfides (PS) hinders the direct application of Al2O3-added electrolytes in all-solid-state lithium-sulfur batteries (ASSLSBs). Herein, the role of Al2O3 in ASSLSBs both as electrolyte filler and cathode additive is studied. The combination of Al2O3-added electrolyte and Al2O3-added S8 cathode with optimum cell configuration could deliver an unprecedented discharge capacity of 0.85 mAh cm⁻² (C/10, 30 cycles) for polymer-based ASSLSBs. These results suggest that the rational incorporation of Al2O3 can lead simultaneously to PS anchoring and Li° anode stabilizing benefits from the ceramic filler, thus improving the electrochemical performance of ASSLSBs.

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