Long-term cycling of ultrathin Li metal anode via interfacial design using silver trifluoromethanesulfonate as an additive

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The use of ultrathin lithium (Li) metal anode in Li metal batteries (LMBs) has the potential to significantly improve the energy density in comparison to the conventional LMBs. However, they possess several challenges such as intrinsic dendrite growth and dead Li, leading to poor cyclability and coulombic efficiency (CE). In addition, the ultrathin Li metal can cause much faster degradation of performances than thicker one owing to the exhaustion of Li resource with less compensation. To address these problems, silver trifluoromethanesulfonate ($AgCF_3SO_3$, AgTFMS) is proposed as a functional electrolyte additive in carbonate-based electrolyte to buffer the dendritic Li growth and to provide enhanced cyclability.[1] Interestingly, Ag metal derived from the AgTFMS exhibits lithiophilic properties through an alloying reaction with Li. Furthermore, the CF_3 functional group of AgTFMS generates a physically stable LiF-rich solid-electrolyte interphase (SEI), which further suppresses the Li dendrite growth. An $LiNi_{0.8}Mn_{0.1}Co_{0.1}O_2$ (NMC811) full-cell comprising the ultrathin Li metal anode (20 μm) with AgTFMS additive reveals an excellent capacity retention of up to 88.2% over 200 cycles, as well as outstanding rate capability under harsh practical conditions. As a result, the AgTFMS additive can pave a new dimension for the design of high energy density LMBs using the ultrathin Li metal anode.

[1] J. H. Sung, U. H. Lee, J. Lee, B. Yu, M. I. Maulana, S.-T. Hong, H. D. Yoo, J. Kang, and J.-S. Yu, Adv. Energy Mater. 2025, 2500279.

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