3D Dendrite-free Lithium Metal Anode in a Foam Host

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Despite the fact that lithium metal is a promising high-energy-density anode material for future lithium batteries, its existing defects, such as dendritic lithium deposition and relative infinity dimension change during long-term cycling, have extremely restricted its practical application. In this contribution, we demonstrated a thermal infusion strategy for pre-storing lithium into a stable nickel foam host, through which a composite anode was achieved. In comparison with the bare lithium, the composite anode exhibits stable voltage profiles (200 mV at 5.0 mA cm\(^{-2}\)) with a small hysteresis beyond 100 cycles in carbonate-based electrolyte, as well as high rate capability, significantly reduced interfacial resistance, and small polarization in a full-cell battery with Li\(_4\)Ti\(_5\)O\(_12\) or LiFePO\(_4\) as counter electrode. More importantly, in addition to the fact that lithium is successfully confined in the metallic nickel foam host, uniform lithium plating/stripping is achieved with a low dimension change (merely \(~3.1\%) and effective inhibition of dendrite formation. The mechanism for uniform lithium stripping/plating behavior is explained based on a surface energy model.

Reference:

Figure 1. A Li-Ni composite anode, which exhibits stable voltage profiles (90 mV at 1.0 mA cm\(^{-2}\)) with small hysteresis beyond 100 cycles, as well as low dimension change and effective dendrite inhibition after 100 cycles in symmetric cell, is achieved via the thermal infusion strategy.