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 $Li_4Ti_5O_{12}$ 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.

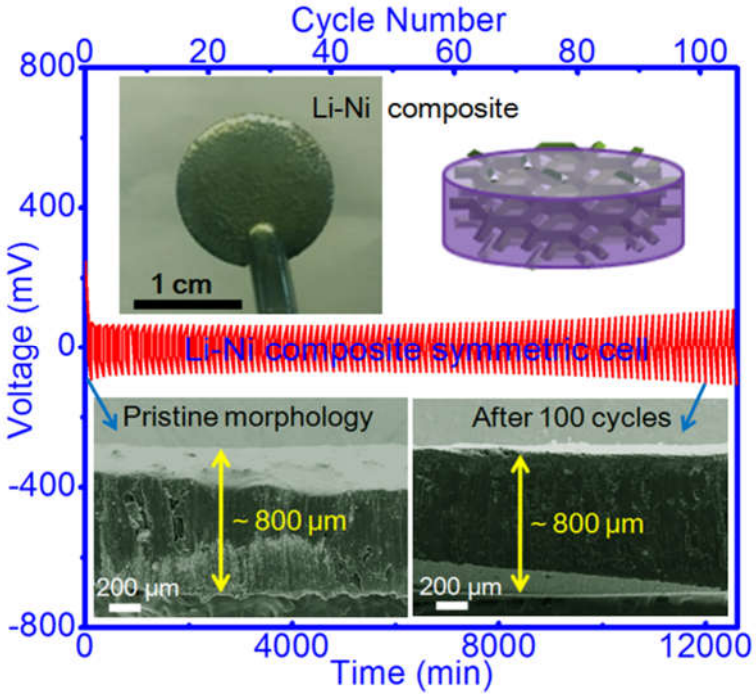

Figure 1. A Li-Ni composite anode, which exhibits stable voltage profiles (90 mV at 1.0 mA cm^{-2}) with small hysteresis beyond 100 cycles, as well as low dimension change and effective dendrite inhibition after100 cycles in symmetric cell, is achieved via the thermal infusion strategy.

References:

[1] S.S. Chi, Y.C. Liu, W.-L. Song, L.-Z. Fan*, Q. Zhang*, Adv. Funct. Mater. 27 (2017) 1700348.