Nanowire-reinforced 3D porous Cu current collector for controllable and dendrite-free Na metal plating/stripping

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Sodium metal anode has always been regarded as most desirable anode in sodium batteries for its ultrahigh theoretic capacity and low deposition/stripping potential, and researches about improving sodium anodes stability are quite crucial. [1] As a result of uneven surface of Cu foil, Na deposition is prone to concentrated on nucleated position instead of bare parts, leading to the formation of dendritic Na and dead Na accompanied by severe safety issues (**Figure 1a**). One of feasible strategies is modification of current collectors via introducing three-dimensional (3D) structures on them, while hierarchical structures and high specific surface area synergistically assure uniform deposition/stripping process. Here we synthesized Cu nanowires on Cu foam by anode oxidation method and heat reduction. The nanowire-reinforced 3D copper foam delivered ultralong cycle life even with a high areal capacity and tiny hysteresis. The superb performance can be attributed to elevated surface area, which markedly reducing current density and benefiting Na^+ infusing. Secondly, deposited sodium can be confined within 3D structure with the formation of stable SEI films, avoiding infinite growth of dendrite towards specific lattice plane (**Figure 1b**). Thirdly, Na deposits with high areal loading guided by copper nanowires can be fully accommodated by expansive internal space of Cu foam.

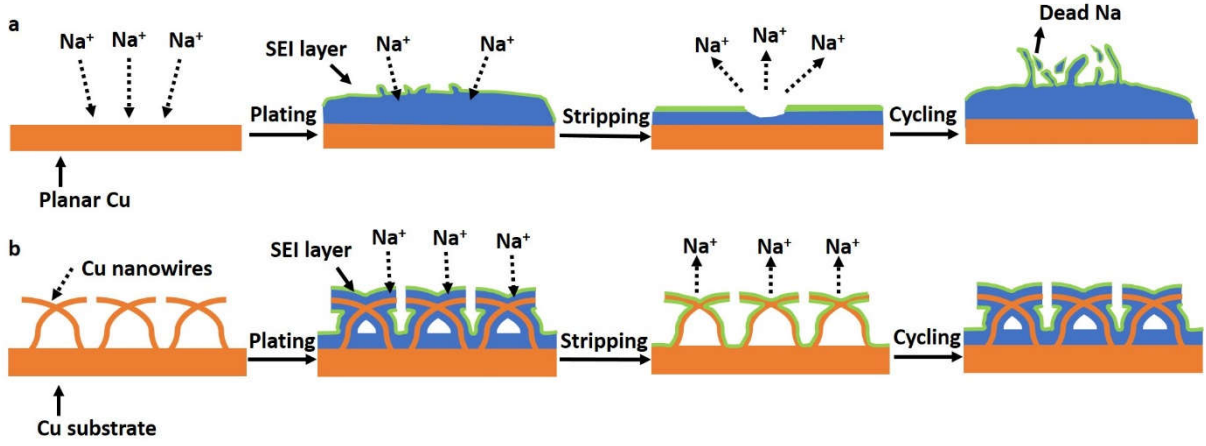

Figure 1. Schematic diagrams showing the Na plating process on 2D Cu foil and CuNW-Cu.

References:

[1] S.S. Chi, X.G. Qi, Y. S. Hu, L.Z. Fan, Adv. Energy Mater. (2017). 1702764.