EuroSciCon

World Congress on

Materials Science & Engineering

August 23-25, 2018
Amsterdam, Netherlands

Nano Res Appl 2018, Volume: 4
DOI: 10.21767/2471-9838-C4-018

SILICIDE NANOWIRE ANODES ANCHORED SELECTIVELY TO THE INNER SURFACE OF GRAPHENE-BASED MICRO-TUBULAR CONDUCTING ELECTRODES FOR ULTRAFAST LITHIUM-ION BATTERIES

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As an alternative to conventional graphite anodes, higher-capacity materials (e.g., Si, Ge, and Sn) with appropriately designed nanostructures have been widely explored. However, problems associated with the unstable evolution of a solid-electrolyte interphase (SEI) on the active anode surface still remain. Considering that the SEI develops on the active anode surface before lithiation starts, most previous research focused on the novel hybrid design to prevent direct contact between electrolyte and anode materials. However, since the Li ion/etchant-permeable shell cannot permanently prevent permeation of electrolyte, these works gave rise to a dispute concerning the permeation of electrolyte and SEI development on the anode surface. In this study, we propose a new approach that prevents the formation of an SEI layer by engineering the electric potential across the electrolyte/anode interface. The silicide nanowire anodes anchored selectively to the inner surface of graphene-based micro-tubules (NiSiNWs@GrμTs) were tested as a proof of concept for the proposed strategy and demonstrated unprecedentedly excellent performance during 2000 cycles at 20C with a high specific capacity (over 700 mAh/g, corresponding to 84% of the initial capacity). Moreover, the NiSiNWs@GrμT anodes showed superior rate capabilities with capacity retention higher than 88% at 80C (vs. the capacity at 1C).

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