Composite of Tin and Silicon with Nanostructure as High Performance Lithium-Ion Battery Anode

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Composite of nanobranched-Si and nanospheres-Sn (denoted as Sn[#]nb-Si) with an appearance of “fruit-branch” is successfully synthesized by two-step method at room-temperature. This two-step method, i.e. dealloying followed by depositing, constructs an intact network of nanobranched-Si (nb-Si) with a harmonious depositing of nanospheres-Sn. The structural design at the nanoscale level buffers the expansion during lithiation/delithiation process, and the depositing of nanospheres-Sn improves the rate of Li⁺ transfer (an increase of 145% compared to pure nb-Si), remedying inherent poor conductivity of Si and achieving enhanced electrochemical performance. As a result, Sn[#]nb-Si exhibits a reversible capacity of 1525.9 mA h g⁻¹ at 100 mA g⁻¹ after 55 cycles with decent rate performance. Furthermore, Sn[#]nb-Si deepens research on the composite of Si and Sn, while dealloying followed by depositing, which is generally facile and uncomplicated, offers a novel guideline to cultivate structural design and paves the way for the synthesis of advanced energy storage materials.

Keywords: LIBs, Si/Sn, anode, composite, dealloying, depositing

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