Partial amorphous tin oxide anchored on 3D hierarchical networks for fully reversible lithium storage

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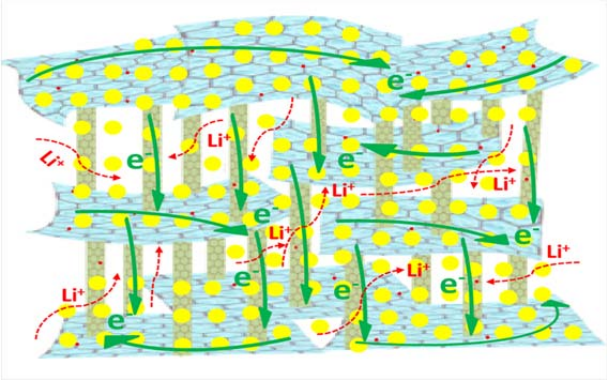
Tin oxide (SnO_2) as anode material for Li-ion batteries has high theoretical capacity of 1493 mAh g^{-1}, however, only about its half percent (782 mAh g^{-1}) will be revisable cycling due to the large irreversible reaction between SnO_2 and Sn at the initial discharge process, which causes great waste of electrode material and disadvantage for commercial application. Herein, a novel concept to achieve fully reversible conversion of SnO_2 as anode material was proposed in our work, that is, the partially amorphous tin oxide anchored on graphene and single carbon nanotube hybrid carbonaceous matrix (PA-SnO_2@G-SWCNT) was prepared by a facile hydrolysis of tin salts method under a low temperature, and the PA-SnO_2@G-SWCNT composite exhibits distinguished electrochemical performance in Li-ion batteries. A specific capacity of 1215 mAh g^{-1} was obtained at a current density of 100 mA g^{-1} after 250 cycles. When the current density as high as 1 A g^{-1}, it's able to display a stable specific capacity of 947 mAh g^{-1} after 350 cycles. It is believed that the superior synergetic effect between 3D structure and partially amorphous nanoparticles makes fully reversible reaction of SnO_2 conversion and excellent electrochemical capacity for lithium storage performance. This work also provides a facile and reasonable strategy to realize fully utilization of tin oxides and its compounds as electrode materials for energy storage.



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