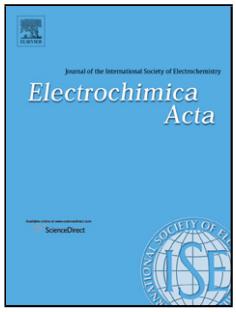

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Polyvinyl Pyrrolidone Wrapped Sn Nanoparticles/Carbon Xerogel Composite as Anode Material for High Performance Lithium Ion Batteries

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Abstract To effectively alleviate the severe volume expansion, pulverization and aggregation of anodes during the charge and discharge processes, we designed novel three-dimensional porous Sn@PVP-CX composites as anodes for lithium ion batteries (LIBs), in which Sn nanoparticles (NPs) are wrapped with outer layer of polyvinyl pyrrolidone (PVP), and the Sn@PVP core-shell nanostructures are homogenously loaded on mesoporous carbon xerogel (CX) matrix. Introducing a flexible and stable layer of PVP on surface of Sn NPs can effectively prevent the aggregation of Sn NPs and counteract the pulverization of Sn NPs due to the large volume changes generated during the lithiation-delithiation processes. CX acted as a conductive matrix, displaying porous structure with merits of continuous porosity, interconnected 3D porous structure and large interfacial surface area, can effectively alleviate the strain and stress from volume changes, provide the sufficient channel for Li ions and electrons, shorten the diffusion path of Li ions. The unique Sn@PVP-CX with Sn@PVP NPs homogenously loaded on the CX matrix can show improved structure stability as LIBs anodes. The LIBs based on Sn@PVP-CX composite anode display greatly improved electrochemical performance, showing a capacity of 757 mA h g^{-1} at a current density of 100 mA g^{-1} after 100 cycles, improved cycling stability and rate capability. The related mechanism is investigated.

Key Words: polyvinyl pyrrolidone; Sn nanoparticless; carbon xerogel; lithium ion battery; anode