Quasi-anisotropic benefits in electrospun nickel– cobalt–manganese oxide nano-octahedron as anode for lithium-ion batteries

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ABSTRACT

Despite having a significantly higher capacity (>1000 mA h g^{-1}) as compared to the conventional graphite anode, the adoption of the conversion-type transition metal oxide (TMO) anodes is restricted due to their inferior cycling stability, sluggish ion transport behavior, high potential plateau *vs.* Li/Li^+, *etc.* Subsequent developments through nanostructuring and chemical composition engineering have improved the electrochemical performance of TMO anodes. Herein, a quasi-anisotropic nano-octahedron quaternary metal oxide composite is designed and synthesized using pilot-scale electrospinning by manipulating the conductivity of the polymeric solution. This morphology is first reported *via* electrospinning, which routinely produces nanofiber morphology. The fabricated nano-octahedron exhibited slightly higher gravimetry specific capacity (~1184 mA h g^{-1} at 100 mA g^{-1}) as compared to the nanofiber counterpart (1075 mA h g^{-1} at 100 mA g^{-1}), with an initial capacity loss of 37.4% and 38.7%, respectively. Owing to the isotropic volume expansion, the nano-octahedron was capable of retaining 78.9% (or 291.2 mA h g^{-1}) capacity after 500 charge/discharge cycles at 1000 mA g^{-1}, compared to the inferior 24.1% (or 71.1 mA h g^{-1}) for its nanofiber counterpart. Overall, the results discussed here provide valuable information on morphology design for future high-performance TMO anodes.

KEYWORDS: Quasi-anisotropic, Rechargeable lithium-ion batteries (LIB), nickel–cobalt–manganese oxide

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