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A Facile Synthetic Protocol to Construct 1D Zn-Mn-Oxide Nanostructures with Tunable Compositions for High-performance Lithium Storage

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ABSTRACT

The synthesis of one-dimensional (1D) Zn-Mn-Oxide (ZMO) for lithium storage is an important research topic, since ZMO can potentially satisfy the ever-increasing demand on the high energy density, natural abundance and long lifespan of lithium ion batteries. Generally, the synthesis of 1D ZMO nanostructures relies on various templates. A facile construction of 1D ZMO nanostructures with tunable compositions via the same synthetic protocol remains a great challenge. Herein, two different Zn-Mn-Oxides of $ZnMn_2O_4$ and $ZnMnO_3$ both with 1D rod morphology were successfully prepared via a simple co-precipitation reaction coupled with subsequent heat treatment. As the anode materials for lithium ion battery, both ZMO nanorods exhibit good lithium storage performances. Especially, $ZnMn_2O_4$ nanorods display superior electrochemical performances to $ZnMnO_3$ nanorods, including higher discharge capacities of 1119.3 and 572.6 mAh g^{-1} at 0.1 C and 0.5 C, respectively and better cyclability with capacity retention of 80% after 300 cycles at 0.5 C. The improved electrochemical properties should be attributed to the porous and interparticle-bridging microstructures in $ZnMn_2O_4$ nanorods, which can offer better contact between electrolyte and anode and tolerate larger volume changes during discharge/charge process.

KEYWORDS: Anode materials; $ZnMn_2O_4$; $ZnMnO_3$; One-dimensional; Li-ion batteries