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Spinel manganese oxide: A high capacity positive electrode material for the sodium ion battery

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Abstract

This is the first report about a spinel manganese oxide that serves as a high capacity positive electrode material for the sodium ion battery. By electrochemically extracting Li from a monoclinic layered Li_2MnO_3 , we prepared $\text{Li}_{2-x}\text{MnO}_3$ ($x = 1.6-1.8$) of which the Li-extracted domain has a cubic spinel structure. The reversible discharge and charge capacity of $\text{Li}_{2-x}\text{MnO}_3$ versus the Na negative electrode initially exceeded $200 \text{ mA}\cdot\text{h}\cdot\text{g}^{-1}$, suggesting that close to one molar equivalent of Na is inserted in and extracted from the formula unit, $\text{Li}_{2-x}\text{MnO}_3$. The electrode retains the capacity of $160 \text{ mA}\cdot\text{h}\cdot\text{g}^{-1}$ after 50 cycles. On the other hand, the $\text{Li}_{2-x}\text{MnO}_3$ electrode versus the Li negative electrode significantly degrades upon cycling.

The *ex-situ* synchrotron X-ray diffraction (SR-XRD) and transmission electron microscopy (TEM) analyses revealed that the spinel domain of $\text{Li}_{2-x}\text{MnO}_3$ retains its crystallographic structure during the Na insertion and extraction, although the crystal significantly loses its periodicity when Na is

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