

Exploring the rate dependence of phase evolution in P2-type $\text{Na}_{2/3}\text{Mn}_{0.8}\text{Fe}_{0.1}\text{Ti}_{0.1}\text{O}_2$

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Abstract

P2-type $\text{Na}_{2/3}\text{Mn}_{0.8}\text{Fe}_{0.1}\text{Ti}_{0.1}\text{O}_2$, a promising high-performance electrode material for use in ambient temperature sodium-ion batteries, is examined using *operando* and long-term *in situ* synchrotron X-ray diffraction studies to reveal the structural evolution during battery function. Variable current cycling at current rates as high as 526 mA g^{-1} (4C) over a wide voltage window (1.5 V to 4.2 V) reveals that the structural transitions of the positive electrode material at higher currents may be suppressed by kinetic limitations which reduce the magnitude of change of the sodium content in the electrode. At low currents, when maximum desodiation is achieved, a collapse in the *c* lattice parameter is observed as the cell reaches the charged state, however this behaviour is not observed during cycling at higher currents.

