Titanium-doped P2-type $\text{Na}_{0.67}\text{Co}_{0.67}\text{Mn}_{0.33-\chi}\text{Ti}_{\chi}\text{O}_2$ ($0 \leq \chi \leq 0.2$) as Novel Cathodes for Sodium Ion Batteries with Superior-Rate

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Sodium ion batteries (SIBs) have attracted increasing attention due to the naturally abundant and inexpensive sodium resources. The layered transition metal oxides are proposed for advanced cathode materials of SIBs. However, the phase transformation and rate performance of layered compounds are still a pivotal challenges. Here, we report a series of Ti-doped $\text{Na}_{0.67}\text{Co}_{0.67}\text{Mn}_{0.33-\chi}\text{Ti}_{\chi}\text{O}_2$ ($0 \leq \chi \leq 0.2$) samples as cathodes for SIBs. As a result, the multiphase transition during the charge-discharge was successfully prohibited by partial Ti doped. It is found that the $\text{Na}_{0.67}\text{Co}_{0.67}\text{Mn}_{0.23}\text{Ti}_{0.1}\text{O}_2$ cathode exhibited superior rate performance and tremendous capacity retention. Particularly, the $\text{Na}_{0.67}\text{Co}_{0.67}\text{Mn}_{0.23}\text{Ti}_{0.1}\text{O}_2$ cathode delivers a initial discharge capacity of about 91.2 mAh g⁻¹ at 1C. More attractively, even at high current rates (10, 15, 20 and 30 C), superior rate capability is achieved while retaining tremendous capacity retention. Nearly 81.02% of the initial capacity was retained after 1000 charge/discharge cycles at 20 C (3.42A g⁻¹). Therefore, Ti-doped $\text{Na}_{0.67}\text{Co}_{0.67}\text{Mn}_{0.23}\text{Ti}_{0.1}\text{O}_2$ may be a promising cathode material for SIBs with excellent rate and cycling performance.

Keywords: Sodium ion batteries; Cathode materials; $\text{Na}_{0.67}\text{Co}_{0.67}\text{Mn}_{0.33-\chi}\text{Ti}_{\chi}\text{O}_2$; Titanium-doping; High-rate

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