$NaVPO_4F$ with High Cycling Stability as a Promising Cathode for Sodium-ion Battery

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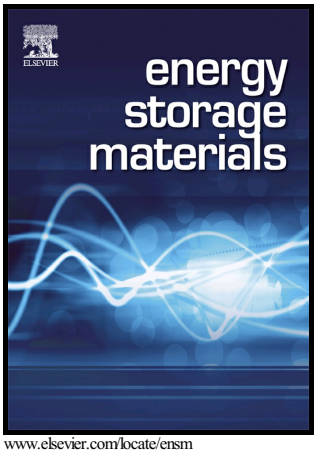

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$NaVPO_4F$ with High Cycling Stability as a Promising Cathode for Sodium-ion Battery

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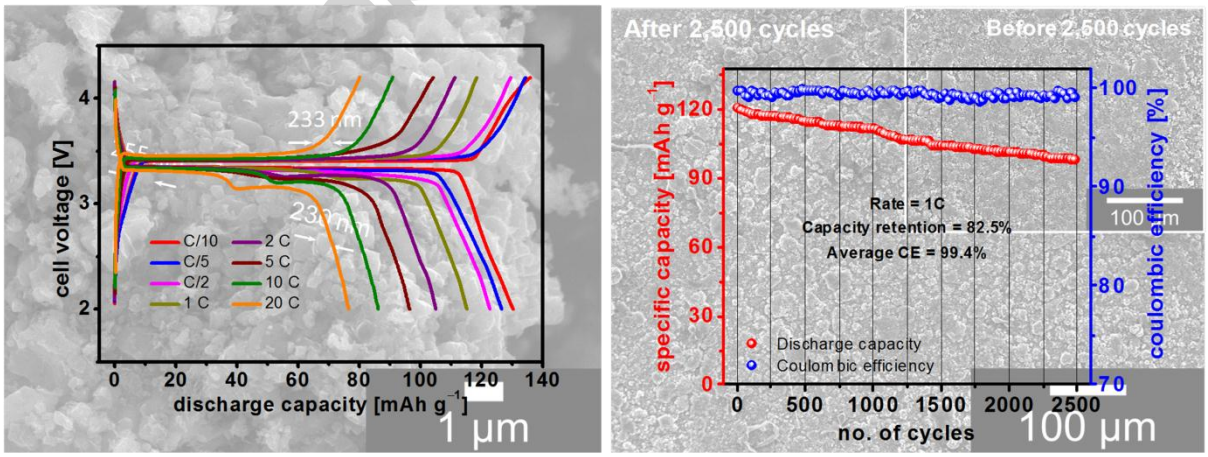
Abstract

In this article, we report a high-performing fluorophosphate-based cathode material for sodium-ion battery, namely $NaVPO_4F$, synthesised by a facile one-step soft template method. We compared physical and electrochemical properties between the $NaVPO_4F$ materials synthesised using V_2O_3 and V_2O_5 as starting precursors. FESEM images show that the samples consist of particles of size in the range 200-800 nm. The synthesised $NaVPO_4F$ using V_2O_5 cycled *vs.* sodium metal at 0.1 C is able to deliver a high discharge capacity of 133 mAh g^{-1}, with a flat discharge plateau at 3.33 V. At a moderate current rate of 1 C, it still manages to achieve a reversible discharge capacity of 121 mAh g^{-1}, and retains 82% of its initial capacity after 2,500 cycles. Notably, this electrode material exhibits impressive long-term cyclabilty at high rates, where it is able to retain 81 and 77 % of respective initial discharge capacities even after 10,000 cycles at 10 and 20 C. This durable performance of $NaVPO_4F$ using V_2O_5 precursor is attributed to the good electrode surface integrity owing to negligible volume changes as confirmed by FESEM experiment.

Graphical Abstract



Keywords: Sodium-ion battery; fluorophosphate; vanadium precursor; long-term cycling; high-rate performance.