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Sodium-rich Iron Hexacyanoferrate with Nickel Doping as a High Performance Cathode for Aqueous Sodium Ion Batteries

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Abstract: Na-rich $\text{Na}_x\text{FeFe}(\text{CN})_6$ (NFF) in terms of low cost and high theoretical capacity has been considered to be a potential cathode material for aqueous sodium ion batteries (SIBs). However, low sodium content, poor Columbic efficiency (CE) and rapid capacity degradation impede their practical application. Herein, the effect of low-level Ni doping in NFF as cathode materials in 1 M NaNO_3 electrolyte has been investigated, which were synthesized via a citrate-assisted co-precipitation route. NFF substituted with 23% Ni^{2+} exhibited the best electrochemical behaviors, which delivers a discharge capacity of 105.9 mAh g^{-1} at 200 mA g^{-1} and 73.1% capacity retention over 1000 cycles with an average CE of 99.8% at 1000 mA g^{-1} . A reversible capacity of 55.5 mAh g^{-1} can be obtained even at a high current density of 2000 mA g^{-1} . The Ni substitution strategy was evidenced to be a scalable method to prepare promising cathode materials with excellent cycling stability for high-performance aqueous SIBs.

Keywords: Prussian blue analogues; sodium-ion batteries; aqueous electrolyte;

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