Scientific Achievement

Controlled substitution in the alkali site of a sodium-ion battery cathode material was utilized to achieve high performance and stability in the cathode. The rational design of cathode materials by substitution enables high structural stability by controlled alien ions - in this case, K\(^+\) is used alongside the Na\(^+\) cathode.

Significance and Impact

The new material, \([K_{0.444(1)}Na_{1.414(1)}][Mn_{3/4}Fe_{5/4}](CN)_6\), was developed as a proof of concept. The cathode displayed increased voltage capacity and stability, with ≈3.65 V versus Na\(^+\)/Na and superior capacity retention of >78% after 1800 cycles.

Research Details

The rational design of a Na-ion cathode via controlled K\(^+\) substitution in the alkali site was studied computationally and experimentally.

- The new material was modeled after prussian-blue analogues, a family of materials with ideal characteristics for rechargeable batteries.
- Typically, substitution of the transition-metal site in NIBs is utilized. This work uses a novel approach of tuning the alkali site.


Work was performed at University of Toronto.

Nanoporous Materials Genome Center
nmgc.umn.edu