Novel cathode designed for high-performance sodium ion batteries

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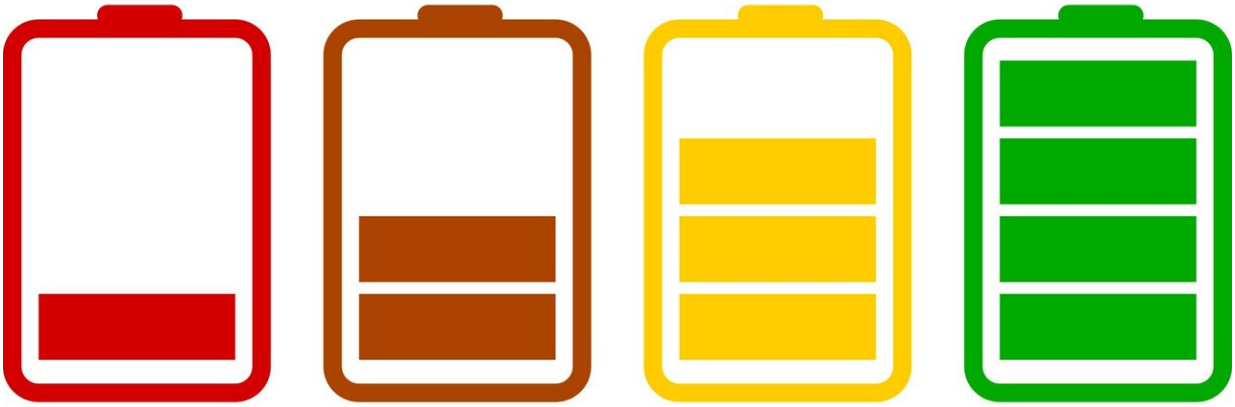

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Due to their large-scale energy storage, sodium ion batteries (SIBs) are a promising alternative to lithium-ion batteries (LIBs). However, it's challenging to develop high-energy and high-power SIBs due to the greater atomic mass and larger ionic radius.

Electrode architecture design with high mass loading of active materials is a more straightforward strategy to achieve high energy. It can increase

the percentage of active materials and consequently energy density at device/cell levels.

Recently, a research group led by Prof. Li Xianfeng and Dr. Zheng Qiong from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) designed and optimized a low-tortuosity and high-areal-capacity cathode for high-rate and ultra-stable SIBs.

The results were published in *Advanced Energy Materials* on March 18.

The researchers proposed a low-tortuosity, finger-like composite electrode with ultra-high mass loading based on nonsolvent-induced phase separation method, which could offer well-pleasing electron/ion transport pathway and relatively low battery resistance.

Benefiting from the structural advantages, they obtained the as-prepared electrode with ultra-high mass loading (60 mg/cm^2) and areal capacity (4.0 mAh/cm^2). Even at a high rate of 10 C, the areal capacity remained 1.0 mAh/cm^2.

The researchers also illustrated the homogeneous Na+ distribution, gentle and uniform local current density and polarization inside the as-prepared electrode.

Combining numerical simulations and experiments, they revealed that the low-tortuosity architecture could contribute to an impressive ion transport capability and consequently significant improvements in electrochemical performance.

This study exhibits a prospective solution for design and optimization of the low-tortuosity electrodes with ultra-high mass loading, which opens a new avenue for developing advanced SIBs with high energy/power

density.

More information: Zhiqiang Lv et al. Controllable Design Coupled with Finite Element Analysis of Low-Tortuosity Electrode Architecture for Advanced Sodium-Ion Batteries with Ultra-High Mass Loading, *Advanced Energy Materials* (2021). DOI: 10.1002/aenm.202003725

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