# Oxygen vacancies boost performance of aqueous zinc ion batteries, study finds

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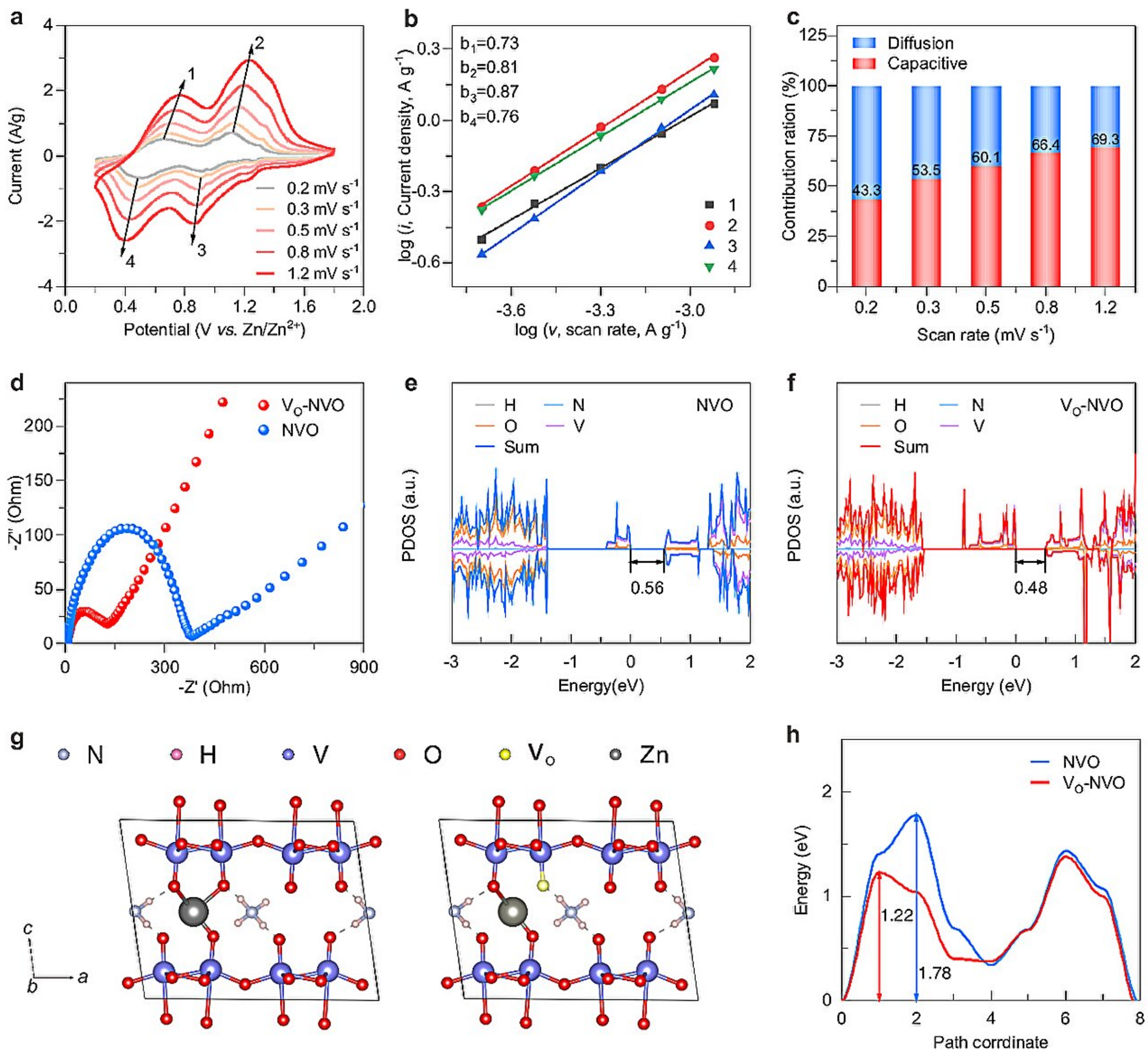


Electrochemical Reaction Kinetics and Density Functional Theory (DFT) calculations. Credit: Li Zhaoqian

According to research published in *Small*, a team led by Prof. Hu Linhua from Hefei Institutes of Physical Science (HFIPS), Chinese Academy of Science (CAS) found that the electrochemical properties of $NH_4V_4O_{10}$ can be successfully enhanced by introducing oxygen vacancies.

"The introduction of oxygen vacancy accelerates the ion and charge transfer kinetics, reduces the diffusion barrier of zinc ions, and establishes a stable crystal structure during zinc ion (de-intercalation)," said Li Zhaoqian, a member of the team.

Aqueous zinc ion batteries (AZIBs) have attracted significant attention among energy storage devices. Vanadium-based compounds have been identified as promising cathode materials for aqueous zinc ion batteries due to their high specific capacity. However, the low intrinsic conductivity and sluggish $Zn^{2+}$ diffusion kinetics seriously impede their further practical application.

In this study, researchers develop a facile hydrothermal approach to introduce oxygen vacancies into $NH_4V_4O_{10}$ nanobelts (denoted as VO-NVO) as a cathode material for high-performance AZIBs.

Generating oxygen vacancies into the NVO lattice can accelerate the ion and charge transfer kinetics, reduce the diffusion barrier of zinc ions, and establish a stable crystal structure during zinc ion (de-intercalation). This defect engineering also facilitates the enhancement of the surface capacitive contribution of NVO due to the higher electrochemical surface reactivity and lower required number of formation electrons.

As a result, the obtained VO-NVO cathode delivers a remarkable capacity of 498.6 mAh $g^{-1}$ at 200 mA $g^{-1}$, exceptional rate capability of 295.6 mAh $g^{-1}$ at 10 A $g^{-1}$ and ultra-long cycling stability with a capacity retention of 95.1% after 4000 cycles at 5 A $g^{-1}$.

This method of introducing oxygen vacancies provides an idea for solving the problem of AZIB high-performance cathodes, according to the team.

**More information:** Yuqi Peng et al, Oxygen Vacancies on NH4V4O10 Accelerate Ion and Charge Transfer in Aqueous Zinc–Ion Batteries, *Small* (2023). DOI: 10.1002/smll.202306972

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