BUHLE POWER

Zinc manganese dioxide flow battery

Overview

Aqueous Zn–Mn flow batteries (Zn–Mn FBs) are a potential candidate for large-scale energy storage due to their high voltage, low cost, and environmental friendliness.Are zinc–manganese dioxide batteries cathode-free?

Authors to whom correspondence should be addressed. Zinc–manganese dioxide (Zn–MnO 2) batteries, pivotal in primary energy storage, face challenges in rechargeability due to cathode dissolution and anode corrosion. This review summarizes cathode-free designs using pH-optimized electrolytes and modified electrodes/current collectors.

Can manganese dioxide be used as a cathode for Zn-ion batteries?

In recent years, manganese dioxide (MnO 2)-based materials have been extensively explored as cathodes for Zn-ion batteries. Based on the research experiences of our group in the field of aqueous zinc ion batteries and combining with the latest literature of system, we systematically summarize the research progress of Zn−MnO 2 batteries.

Are alkaline zinc-manganese dioxide batteries rechargeable?

Nature Communications 8, Article number: 405 (2017) Cite this article Although alkaline zinc-manganese dioxide batteries have dominated the primary battery applications, it is challenging to make them rechargeable. Here we report a high-performance rechargeable zinc-manganese dioxide system with an aqueous mild-acidic zinc triflate electrolyte.

What is a zinc–manganese battery?

Zinc–manganese batteries are typically dry cells that can be bought from supermarkets. The evolution from non-rechargeable zinc–manganese dry cells to zinc–manganese flow batteries (Zn–Mn FBs) signifies a crucial step towards scalable and sustainable energy storage.

Zinc manganese dioxide flow battery

[MIT scientists develop semisolid zinc ...]

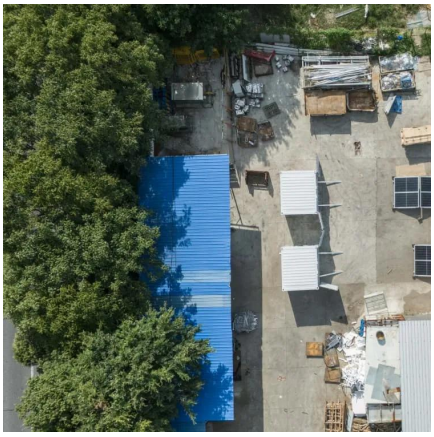
Dec 2, 2021 · MIT researchers have created a semisolid flow battery that might be able to outperform lithium-ion and vanadium redox flow ...

[Cation-regulated MnO 2 reduction reaction ...]

Cation-regulated MnO2 reduction reaction enabling long-term stable zinc-manganese flow batteries with high energy density + Yiqiao Wang, ...

[Rechargeable Zn-MnO2 Batteries: Progress, Challenges, ...]

Dec 22, 2023 · In recent years, manganese dioxide (MnO 2)-based materials have been extensively explored as cathodes for Zn-ion batteries. Based on the research experiences of ...



[A Short Review: Comparison of ...]

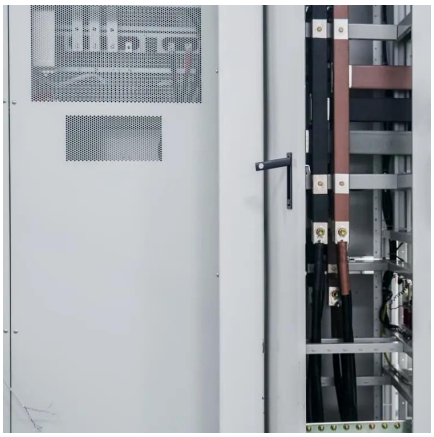
May 12, 2023 · As the world moves towards sustainable and renewable energy sources, there is a need for reliable energy storage systems. A ...

[Optimized preparation of delta-manganese oxide for energetic zinc](#)

Feb 28, 2025 · Abstract Manganese oxide (MnO2) with remarkable advantages of high-safety, low-cost, and environmental friendliness has attracted much attention as a cathode material in ...

Cation-regulated MnO2 reduction reaction enabling long-term stable zinc

Jan 7, 2025 · Cation-regulated MnO 2 reduction reaction enabling long-term stable zinc-manganese flow batteries with high energy density +



[Recent Advances in Aqueous Zn,,MnO_2 Batteries](#)

Recently, rechargeable aqueous zinc-based batteries using manganese oxide as the cathode (e.g., MnO2) have gained attention due to their inherent safety, environmental friendliness, ...

[A key advance toward practical aqueous Zn/MnO2 batteries ...]

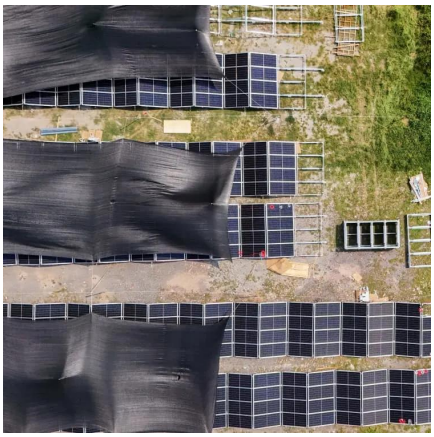
Jan 15, 2025 · Rechargeable aqueous devices, such as alkaline Zn/MnO2 batteries, hold strong potential for large-scale energy storage. However, they face limitations...

[A highly reversible neutral zinc/manganese ...]

Dec 17, 2019 · Manganese (Mn) based batteries have attracted remarkable attention due to their attractive features of low cost, earth abundance and ...

[CHAPTER 5 RECHARGEABLE ZINC BATTERIES FOR GRID ...]

Sep 3, 2021 · In particular, alkaline battery chemistries with zinc electrodes, such as zinc-manganese oxide (Zn-MnO2), zinc-nickel (Zn-Ni), and zinc-air (Zn-air), are already ...

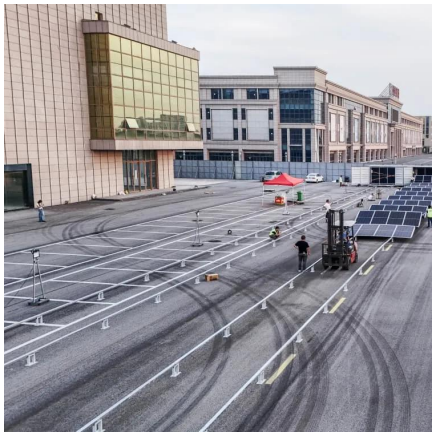


[From Charge Storage Rulebook Rewriting to ...]

Jul 2, 2025 · Aqueous zinc-manganese oxide (Zn-MNO) batteries represent a compelling solution for grid-scale energy storage due to their inherent ...

[Rechargeable aqueous zinc-manganese dioxide batteries ...]

Sep 1, 2017 · Here we report a high-performance rechargeable zinc-manganese dioxide system with an aqueous mild-acidic zinc triflate electrolyte.



[Review of zinc-based hybrid flow batteries: From fundamentals ...]

Jun 1, 2018 · Zinc-based hybrid flow batteries are one of the most promising systems for medium- to large-scale energy storage applications, with particular advantages in terms of cost, cell ...

From Charge Storage Rulebook Rewriting to Commercial Viability of Zinc

Jul 2, 2025 · Aqueous zinc-manganese oxide (Zn-MNO) batteries represent a compelling solution for grid-scale energy storage due to their inherent safety, cost-effectiveness and ecological ...

[Cation-regulated MnO2 reduction reaction ...]

Jan 7, 2025 · Cation-regulated MnO 2 reduction reaction enabling long-term stable zinc-manganese flow batteries with high energy density +

[Recent Advances in Aqueous Zn,,MnO2 Batteries]

Mar 14, 2024 · Abstract Recently, rechargeable aqueous zinc-based batteries using manganese oxide as the cathode (e.g., MnO2) have gained attention due to their inherent safety, ...

[Low-cost manganese dioxide semi-solid electrode for flow batteries]

Nov 17, 2021 · Flow battery architecture is suitable for this purpose because it allows the energy components to be scaled independently from the power components. We explored the ...

[Recent Progress in Cathode-Free Zinc Electrolytic MnO2 Batteries]

Apr 23, 2025 · Zinc-manganese dioxide (Zn-MnO2) batteries, pivotal in primary energy storage, face challenges in rechargeability due to cathode dissolution and anode corrosion. This review ...

[Reversible metal ionic catalysts for high-voltage aqueous hybrid zinc]

Jan 1, 2023 · We report a high voltage aqueous hybrid zinc-manganese flow battery with double-membrane and three-electrolyte configuration, showing a high operating voltage of 2.75 V. To ...

[Recent Progress in Cathode-Free Zinc ...]

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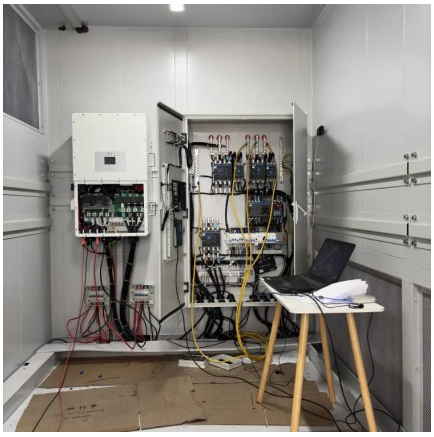

[Decoupling electrolytes towards stable and high-energy]

Article Published: 16 March 2020 Decoupling electrolytes towards stable and high-energy rechargeable aqueous zinc-manganese dioxide batteries Cheng Zhong, Bin Liu, Jia Ding, ...

[Advancing Zinc-Manganese Oxide Batteries: Mechanistic ...]

Sep 18, 2025 · In recent years, a variety of representative energy storage systems have been developed, including sodium-ion batteries (SIBs), zinc-ion batteries (ZIBs), and ...

[Rechargeable aqueous zinc-manganese dioxide batteries ...]

Sep 1, 2017 · Although alkaline zinc-manganese dioxide batteries have dominated the primary battery applications, it is challenging to make them rechargeable. Here we report a high ...

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