



LOTWA SYSTEM

# Zinc-manganese ion flow battery





## Overview

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Are zinc-manganese dioxide batteries cathode-free?

Authors to whom correspondence should be addressed. Zinc-manganese dioxide (Zn-MnO<sub>2</sub>) 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.

Are aqueous zinc-ion batteries the future of energy storage?

Aqueous zinc-ion batteries (AZIBs) are emerging as a promising option for next-generation energy storage due to their abundant resources, affordability, eco-friendliness, and high safety levels. Manganese-based cathode materials, in particular, have garnered significant attention because of their high theoretical capacity and cost-effectiveness.

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.

Are aqueous zinc-iodine flow batteries promising?

Among the array of prospective systems, aqueous zinc-iodine flow batteries (Zn-I FBs) manifest promising potential due to low cost, intrinsic safety, and high theoretical volumetric capacity (268 Ah L<sup>-1</sup>) (Fig. 1a) 11, 12, 13, 14, 15, 16.



## Zinc-manganese ion flow battery

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A highly reversible neutral zinc/manganese battery for ...

Nov 14, 2019 · Unlike the alkaline electrolytes, a neutral flow system can effectively avoid the zinc dendrite issues. As a result, a Zn-Mn flow battery demonstrated a CE of 99% and an EE of ...

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Recent Progress in Cathode-Free Zinc ...

Apr 23, 2025 · Zinc-manganese dioxide (Zn-MnO<sub>2</sub>) batteries, pivotal in primary energy storage, face challenges in rechargeability due to cathode ...

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Advancements in Manganese-Based Cathodes for Aqueous Zinc-Ion Batteries

Aqueous zinc-ion batteries (AZIBs) have emerged as a promising energy storage solution due to their eco-friendly aqueous electrolytes, high theoretical capacity of zinc anodes, and abundant ...

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Tuning the solvation structure of zinc ions via urea enables ...

Oct 15, 2025 · This work proposes a novel strategy utilizing urea as a bifunctional anolyte additive for zinc-manganese (Zn Mn) flow batteries to regulate dead zinc formation and mitigate ...

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Advances in manganese-based cathode ...

Feb 28, 2025 · Aqueous zinc-ion batteries (AZIBs) are emerging as a promising option for next-generation energy storage due to their abundant ...

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Recent Advances in Aqueous Zn<sub>x</sub>MnO<sub>2</sub> Batteries

Jan 27, 2024 · Recently, rechargeable aqueous zinc-based batteries using manganese oxide as the cathode (e.g., MnO<sub>2</sub>) have gained attention due to their inherent safety, environmental ...

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Advances in manganese-based cathode electrodes for aqueous zinc-ion

Feb 28, 2025 · Aqueous zinc-ion batteries (AZIBs) are emerging as a promising option for next-generation energy storage due to their abundant resources, affordability, eco-friendliness, and ...

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Effective Proton Conduction in Quasi-Solid ...

Nov 12, 2024 · Abstract Elusive ion behaviors in aqueous electrolyte remain a challenge to break through the practicality of aqueous zinc-manganese ...

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Cation-regulated MnO<sub>2</sub> reduction reaction enabling long-term stable zinc

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

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Long-life aqueous zinc-iodine flow batteries enabled by

Oct 21, 2025 · Aqueous zinc-iodine flow batteries show potential in large-scale storage but face water imbalance-induced instability. Here, authors develop a tailored ionic-molecular sieve ...

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Cation-regulated MnO<sub>2</sub> reduction reaction ...

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

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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 ...

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Effective Proton Conduction in Quasi-Solid Zinc-Manganese Batteries ...

Nov 12, 2024 · Abstract Elusive ion behaviors in aqueous electrolyte remain a challenge to break through the practicality of aqueous zinc-manganese batteries (AZMBs), a promising candidate ...

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Recent Progress in Cathode-Free Zinc Electrolytic MnO<sub>2</sub> Batteries

Apr 23, 2025 · Zinc-manganese dioxide (Zn-MnO<sub>2</sub>) batteries, pivotal in primary energy storage, face challenges in rechargeability due to cathode dissolution and anode corrosion. This review ...

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Advancements in Manganese-Based ...

Aqueous zinc-ion batteries (AZIBs) have emerged as a promising energy storage solution due to their eco-friendly aqueous electrolytes, high ...

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