

# Aqueous lithium yttrium energy storage battery

The new research project aims to develop a new kind of aqueous battery, one that is environmentally safe, has higher energy density than lead-acid batteries, and costs one-tenth that of lithium ...

A new class of "water-in-eutectogel" electrolytes (WiETGs) is created to support quasi-solid-state aqueous lithium ion batteries. The obtained WiETGs exhibit both high safety ...

Although there have been some studies reviewing the application of polymers in energy storage field, such as lithium-ion batteries and lithium-sulfur batteries, and some articles on the application of polymers in AZIBs have only reviewed their application in a certain aspect. ... Kumankuma-Sarpong et al. [110] synthesized yttrium vanadium oxide ...

The global demand for safe and environmentally sustainable electrochemical energy storage has vastly increased in the recent years. Aqueous lithium-ion energy storage systems (ALESS), such as aqueous Li-ion batteries and supercapacitors, are designed to address safety and sustainability concerns (1, 2). However, significant capacity fading after repeated ...

Aqueous rechargeable lithium batteries (ARLBs) may be an ideal energy storage system due to its excellent safety and reliability. However, since the introduction of ARLBs in 1994, the ...

**Abstract** The electricity grids with high stability and reliability require a desired balance of energy supply and demand. As the typical sustainable energy, the intermittent solar and wind would result in electricity grid instability. Aqueous batteries have been considered to be appealing stationary power sources for sustainable energy. Advanced aqueous batteries can ...

Developing reliable and safe energy storage technologies is in increasing demand for portable electronics and automobile applications [1]. As one of the emerging secondary batteries, rechargeable aqueous zinc-ion batteries (AZIBs) are prevailing over conventional lithium-ion batteries counterparts in terms of low cost, environmental benignity, ...

This new hydronium-ion battery achieved a high energy density ( $132.6 \text{ Wh kg}^{-1}$ ) and supercapacitor-like power density ( $30.8 \text{ W kg}^{-1}$ ), which were approximated to those of aqueous lithium-ion battery.

Energy storage technologies have various applications across different sectors. They play a crucial role in ensuring grid stability and reliability by balancing the supply and demand of electricity, particularly with the integration of variable renewable energy sources like solar and wind power [2]. Additionally, these technologies facilitate peak shaving by storing ...

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Hesse, H., Schimpe, M., Kucevic, D. & Jossen, A. Lithium-ion battery storage for the grid--a review of stationary battery storage system design tailored for applications in modern power grids ...

For the first time, this work investigates the synergetic impact of yttrium (Y) and aluminium (Al) co-doping on the electrochemical properties of 4.6 V LiCoO<sub>2</sub> (LCO) cathode for high energy density lithium-ion batteries. The optimized LCO demonstrates an impressive initial discharge capacity of 208.6 mAh g<sup>-1</sup> in the voltage range of 3-4.6 V, along with superior ...

Increasing research interest has been attracted to develop the next-generation energy storage device as the substitution of lithium-ion batteries (LIBs), considering the potential safety issue and the resource deficiency [1], [2], [3] particular, aqueous rechargeable zinc-ion batteries (ZIBs) are becoming one of the most promising alternatives owing to their reliable ...

A system integrating CO<sub>2</sub> conversion and energy storage holds great promise, but faces a major challenge due to degraded catalysts on charge. Here, the authors present a highly efficient energy ...

Aqueous batteries have garnered significant attention in recent years as a viable alternative to lithium-ion batteries for energy storage, owing to their inherent safety, cost-effectiveness, and environmental sustainability. ... cutting-edge high-energy aqueous battery designs are emphasized as a reference for future endeavors in the pursuit of ...

Aqueous lithium-ion batteries (ALIBs) are promising candidates for sustainable energy storage, offering great advantages in safety, cost, and environmental impact over the conventional nonaqueous LIBs. This paper delves into the forefront of ALIB research in electrolyte formulations, electrode materials, and design strategies of ALIBs that have ...

2.2 Electrode/Electrolyte Interphase Deposition. LMO||V<sub>2</sub>O<sub>5</sub> cells based on the 2 m LiTFSI electrolyte were more closely investigated since V<sub>2</sub>O<sub>5</sub> displayed decent capacity therein while at the same time retaining all redox features associated with operation in a dilute aqueous electrolyte. Two experimental EQCM-D cell configurations were designed to ...

The theoretical energy densities of the aqueous lithium-air battery are 1,910 W h kg<sup>-1</sup> and 2,004 W h L<sup>-1</sup>, which are lower than those of non-aqueous lithium-air batteries but five and two times higher than those of the conventional lithium-ion batteries in terms of mass and volume, respectively (Yamamoto, 2014).

Aqueous batteries (ABs), based on water which is environmentally benign, provide a promising alternative for safe, cost-effective, and scalable energy storage, with high power density and ...

Aqueous zinc-ion batteries (AZIBs) lately garner a lot of interest and are viewed as a promising energy storage

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technology due to their low cost, eco-friendliness, and exceptional safety. Crystal metal oxide cathode research has advanced significantly in recent years, making AZIBs a viable choice for low-cost grid storage applications.

an yttrium-ion source electrode material When combined in the usual manner with an ion receptor counter-electrode material and an electrolyte, e.g., a solution of a dissociable yttrium compound in a non-aqueous solvent, an yttrium-ion source electrode material comprises an electrolytic battery cell with a specific capacity in the range of up to about 250 to 350 mAh/g which may be ...

Reliable energy storage technology is imperative to provide us the energy on demand and reduce our reliance on the fossil fuels. Lithium ion batteries (LIBs) are undoubtedly playing a dominant role in the global energy market by powering many consumer electronics.

The key to developing aqueous batteries is expanding the electrochemical window. The concept of "water-in-salt" has been applied to multiple water-based electrochemical systems. ... Xu, S. et al. Chloride ion batteries-excellent candidates for new energy storage batteries following lithium-ion batteries. *Ionics* 30, 27-38 (2024). <https://doi.org/10.1007/s00194-024-01888-8> ...

Aqueous zinc ion batteries (AZIBs) are an ideal choice for a new generation of large energy storage devices because of their high safety and low cost. Vanadium oxide-based materials have attracted great attention in the field of AZIB cathode materials due to their high theoretical capacity resulting from their rich oxidation states. However, the serious structural ...

Owing to their high energy density and long cycle life, lithium-ion batteries (LIBs) seem the natural choice for these emerging markets. However, typical LIBs with flammable liquid non-aqueous electrolytes suffer from potential safety concerns such as leakage and fire, especially under extreme conditions such as high pressure and deformation ...

a Ragone plot showing the specific energy and power of the aqueous Mn cells with various commercial energy storage devices 60. b Comparison of the general features between Mn and Zn 6 . Full size ...

The energy storage devices that convert chemical energy into electrical energy are relatively mature, and the effective methods for storing intermittent clean energy can achieve a large-scale energy transmission. Rechargeable lithium ion batteries (LIBs), which have the advantages of high energy density, long cycle life, and small size, have ...

Due to the intrinsic structural stability, materials with polyanionic framework have attracted worldwide attention to build-up aqueous metal-ion batteries for large-scale energy storage. Anion-dependent electrochemical behaviors of graphene-modified  $\text{Na}_3\text{V}_2(\text{PO}_4)_3$  (rGO/NVP/C) with rhombohedral structure have been explored. Compared to common ...

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The outstanding energy density, low cost, facile cell assembly along with the important safety implications of an aqueous electrolyte, make this aqueous aluminum-ion battery promising for large ...

Aqueous batteries (ABs) are safer alternatives compared with current LIBs, SIBs, and PIBs. The use of aqueous electrolytes also offers tremendous competitiveness in terms of (i) low cost, the electrolyte and manufacturing costs are reduced by excluding oxygen-free and drying assembly lines; (ii) environmental benignity, because of the nonvolatility, nontoxicity, and ...

As one of the most promising energy storage systems, conventional lithium-ion batteries based on the organic electrolyte have posed challenges to the safety, fabrication, ...

Abstract Aqueous rechargeable batteries (ARBs) have become a lively research theme due to their advantages of low cost, safety, environmental friendliness, and easy manufacturing. However, since its inception, the aqueous solution energy storage system has always faced some problems, which hinders its development, such as the narrow ...

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