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# Aqueous Zinc-Ion Batteries: INST Mohali's BDIM Breakthrough

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CURATED &amp; WRITTEN BY

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# Aqueous Zinc-Ion Batteries: INST Mohali's BDIM Breakthrough

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## WHY IN NEWS

The Institute of Nano Science and Technology (INST), Mohali, developed a novel electrolyte additive called BDIM for aqueous zinc-ion batteries (AZIBs), reported in mid-June 2026 with the study appearing in the journal *ACS Electrochemistry*. The additive enabled symmetric zinc-zinc test cells to operate for over 1,400 hours.

The work addresses a central bottleneck in grid-scale energy storage: finding battery chemistries that are safe, cheap and durable enough to store the surplus generated by India's expanding solar and wind capacity.

## WHAT ARE AQUEOUS ZINC-ION BATTERIES?

An aqueous zinc-ion battery uses a water-based electrolyte and a metallic zinc anode. This makes it fundamentally different from the lithium-ion battery, whose flammable organic electrolyte poses fire risk.

## AZIBs versus Lithium-Ion

FEATURE	AQUEOUS ZINC-ION	LITHIUM-ION
Electrolyte	Water-based, non-flammable	Flammable organic solvent
Safety	High	Fire and thermal-runaway risk
Cost	Lower (zinc is abundant)	Higher (lithium, cobalt)
Energy density	Lower	Higher
Best use	Stationary grid storage	Portable devices, EVs

Because zinc is abundant and the electrolyte is water, AZIBs are attractive for stationary, grid-scale storage where weight and compactness matter less than safety and cost.

## THE PROBLEM THE RESEARCH SOLVED

Zinc anodes in water-based cells suffer from three linked failures:

- **Hydrogen evolution:** Water can split at the anode, releasing hydrogen gas and wasting energy.
- **Corrosion:** The zinc surface degrades over repeated cycles.
- **Dendrite formation:** Uneven zinc deposition grows needle-like “dendrites” that can pierce the separator and short the cell.

These problems sharply shorten battery life. The BDIM additive engineered by INST Mohali modifies the chemistry at the zinc surface to suppress all three failure modes at once. The result, symmetric Zn//Zn cells lasting more than 1,400 hours, demonstrates greatly improved cycling stability.

## WHY IT MATTERS FOR INDIA

DIMENSION	SIGNIFICANCE
Energy storage	Enables firming of intermittent solar and wind
Safety	Non-flammable chemistry suits dense and rural sites
Self-reliance	Reduces dependence on imported lithium
Affordability	Zinc-based cells lower the cost of storage

India’s renewable-energy ambition, including a target of 500 GW of non-fossil capacity by 2030, hinges on cheap and safe storage to balance the grid when the sun does not shine and the wind does not blow. Lithium import dependence is a strategic **vulnerability** (<https://ujiyari.com/vocab/vulnerability/>), so indigenous, abundant-material chemistries reduce risk.

## ABOUT INST MOHALI

The Institute of Nano Science and Technology, Mohali, is an autonomous institute under the Department of Science and Technology (DST). It conducts research at the intersection of nanoscience, materials, energy and healthcare.

## ANALYSIS AND WAY FORWARD

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The breakthrough is at the laboratory scale, and the journey from a long-lived test cell to a commercial grid battery requires scaling up, manufacturing engineering and field validation. The way forward is to move promising chemistries through pilot lines, integrate them with India's storage-procurement and viability-gap funding schemes, and protect the intellectual property. A diversified storage portfolio, lithium-ion for mobility and zinc-ion or sodium-ion for the stationary grid, best serves both energy security (<https://ujiyari.com/terms/energy-security/>) and the net-zero pathway.

## UPSC RELEVANCE

- GS3 (Science and Technology / Environment): indigenous technology, energy storage, renewable-energy integration.
- Prelims: AZIB characteristics, INST Mohali under DST, difference from lithium-ion.
- Mains: Why is energy storage the critical enabler of India's renewable-energy transition, and how can indigenous research reduce import dependence?

## FACTS CORNER

### ★ FACTS CORNER — KNOWLEDGEPEDIA

INST Mohali is the Institute of Nano Science and Technology, an autonomous body under the Department of Science and Technology (DST).

The BDIM additive suppresses hydrogen evolution, corrosion and zinc dendrites in aqueous zinc-ion batteries.

Symmetric Zn//Zn cells with the additive lasted over 1,400 hours; the study appeared in ACS Electrochemistry.

AZIBs use a water-based, non-flammable electrolyte and are cheaper than lithium-ion, suiting grid-scale storage.

India targets 500 GW of non-fossil capacity by 2030 and net-zero by 2070.

*Sources: Department of Science and Technology (<https://dst.gov.in>), Press Information Bureau (<https://pib.gov.in>), DD News (<https://ddnews.gov.in>)*

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