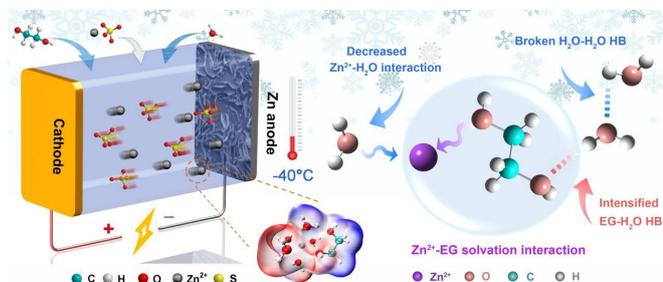


Scientists develop low-temperature resisting aqueous zinc-based batteries

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Schematic illustration of the ZBBs with hybrid electrolytes at low temperatures and possible mechanism of how Zn^{2+} -EG solvation interaction impacts the chemistry of the hybrid electrolyte. Credit: CHANG Nana

Aqueous zinc-based batteries (ZBBs) are widely used for portable and grid-scale applications due to their high safety, low cost and high energy density.

However, the inhomogeneous [zinc](#) deposition on anode during charging and the zinc dendrite formation decrease the cycling stability of ZBBs. Moreover, the traditional aqueous electrolytes are not capable of working at [low temperature](#) due to the suddenly dropped ionic conductivities, limiting the applicable temperature range of aqueous ZBBs.

Recently a research group led by Prof. Li Xianfeng from the Dalian Institute of Chemical Physics (DICP) of the Chinese Academy of Sciences (CAS) developed a low-temperature resisting, cost-effective, safe and eco-friendly hybrid [electrolyte](#) for aqueous ZBBs.

This work was published in *Energy & Environmental Science*.

The developed electrolyte, consisting of water

(H_2O), [ethylene glycol](#) (EG) and zinc sulfate (ZnSO_4), exhibited high zinc-ion conductivity at low temperature.

"We demonstrated the unique solvation interaction of Zn^{2+} with EG through experiments together with theoretical calculation," said Prof. Li.

This interaction could not only enhance the hydrogen bonding between EG and H_2O , providing the hybrid electrolyte with lower freezing point, but also weakened the solvation interaction of Zn^{2+} with H_2O , achieving highly reversible Zn/Zn^{2+} chemistry and uniform zinc deposition.

Both the Zn-ion hybrid supercapacitors (ZHSCs) and Zn-ion batteries (ZIBs) with the hybrid electrolytes showed high [energy](#) densities, high power densities and long-cycle life at $-20\text{ }^\circ\text{C}$. This series of hybrid electrolytes with tunable EG-to- H_2O ratios provided good balance between performance and cost, which enabled promising application in various regions.

This work offers enlightenment for designing electrolytes for low-temperature energy storage devices. It was supported by the Natural Science Foundation of China and CAS Engineering Laboratory for Electrochemical Energy Storage.

More information: Nana Chang et al, An Aqueous Hybrid Electrolyte for Low-Temperature Zinc-Based Energy Storage Devices, *Energy & Environmental Science* (2020). [DOI: 10.1039/D0EE01538E](https://doi.org/10.1039/D0EE01538E)

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