

Diminishing ether-oxygen content of electrolytes enables temperature-immune lithium metal batteries

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The introduction of oxygen-free n-Hexane reduces the side reactions between electrolyte and Li-metal to the greatest extent and greatly promotes Li⁺ desolvation. Credit: Science China Press

Oxygen-free n-Hexane (HEX), the most stable solvent against Li-metal, was successfully introduced into the standard concentration electrolyte to constitute an electrolyte for temperature-immune lithium-metal



batteries.

Since <u>lithium metal</u> has the lowest electrode potential and largest specific capacity, thus employing lithium metal can push the energy density of Li-ion batteries to its limits. However, the high reactivity of lithium metal and the serious Li dendrite growth seriously restrict the development of Li-metal anodes.

Furthermore, Li-metal <u>anode</u> is highly temperature-sensitive, exhibiting aggravated side reactions between Li metal anodes and the <u>electrolyte</u> as temperatures rise and exacerbating Li dendrite growth as temperatures fall. It has failed to achieve high Coulombic efficiency (CE) and uniform Li deposition for Li metal anodes at <u>extreme temperatures</u>.

In a study <u>published</u> in the journal *Science China Chemistry*, researchers first proposed an oxygen-free solvent (alkane) non-reactive against lithium-metal to constitute an electrolyte for temperature-immune lithium-metal batteries. It was discovered that the introduction of oxygenfree HEX reduces the side reactions between electrolyte and Li-metal to the greatest extent and greatly promotes Li⁺ desolvation, leading to ultrahigh Li Coulombic efficiencies (99.59% at 25°C, 99.30% at 60°C and 98.75% at -30 °C) and dendrite-free structure at a wide temperature range (from -30 to 60 °C).

Furthermore, their electrolyte enables the energy density of the SPAN $(3.8 \text{-mAh cm}^{-2})\parallel\text{Li}(60\text{-}\mu\text{m})$ pouch-cells to increase from conventional 221 to 278 Wh kg⁻¹ under the given E/S=3.2 μL mg⁻¹, and also maintain 248 and 320 Wh kg⁻¹ energy density at -30 and 60 °C, respectively.

The research was led by Prof. Liumin Suo (Institute of Physics, Chinese Academy of Sciences).

More information: Tao Liu et al, Diminishing ether-oxygen content



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