Unheeded failure mechanism of magnesium metal anode

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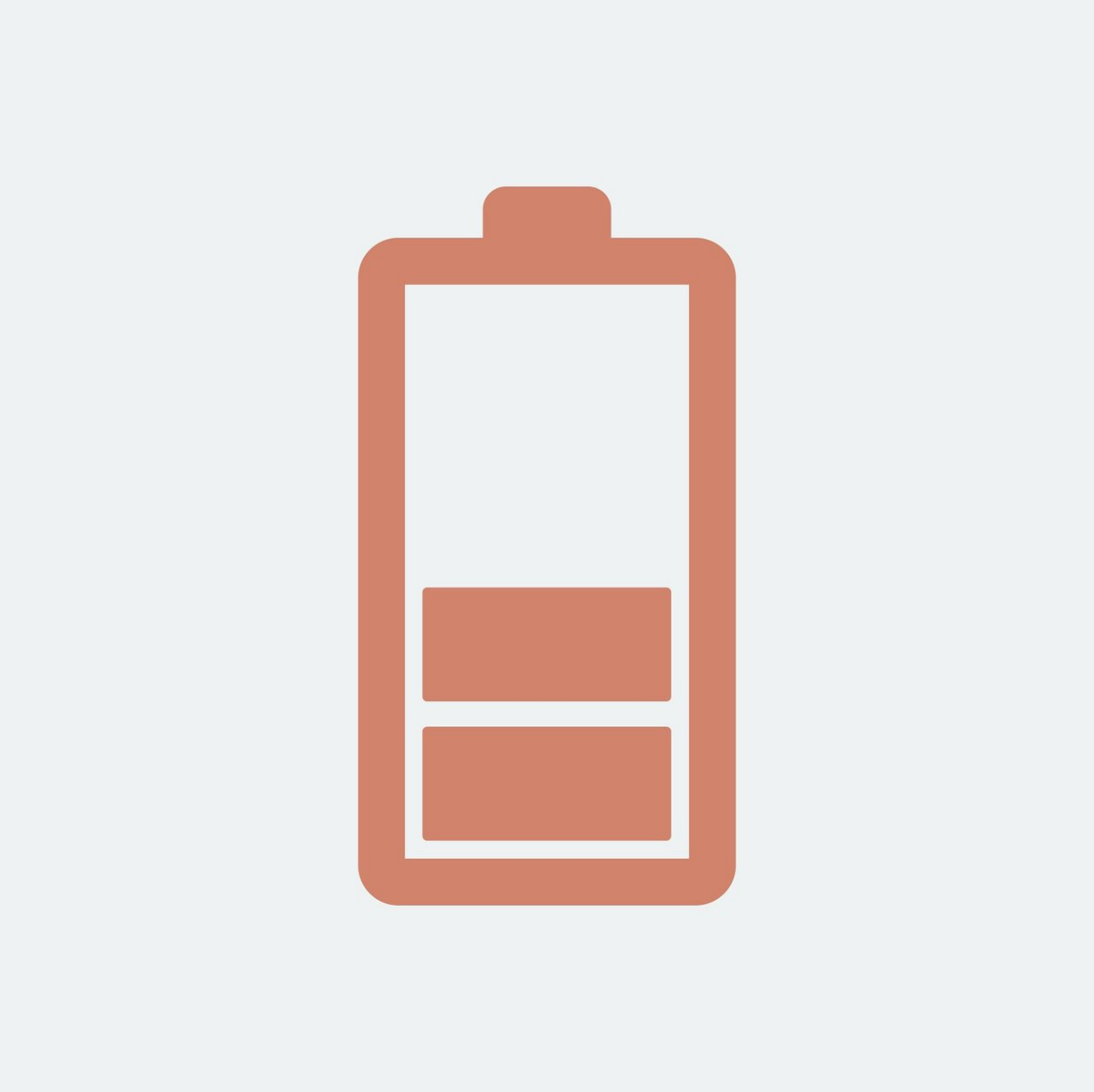

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Among post-lithium-ion battery technologies, rechargeable magnesium (Mg) batteries utilizing divalent Mg^{2+} as charge carriers are expected to offer substantial improvements in volumetric energy density and sustainability of batteries.

Now, a research team led by researchers from the Qingdao Institute of Bioenergy and Bioprocess Technology (QIBEBT), Chinese Academy of Sciences (CAS), has revealed an unheeded failure mechanism of the Mg metal anode, which may promote the development of Mg metal anode battery from a new perspective.

This study was published on June 8 in *Advanced Materials*.

"The initial plating Mg can be undoubtedly uniform in wide range of current densities and under a practical areal capacity. However, an unusual self-accelerating pit growth is observed in the Mg stripping side, which severely deteriorates the anode integrity and subsequent Mg plating uniformity, causing Mg metal anode failure or short circuit of battery," said Liu Xin, doctoral candidate at QIBEBT and lead author of the study.

The research team utilized macroscopic and microscopic characterization methods to investigate the plating/stripping behavior of Mg metal anode under various current density. The experimental results proved the dendrite-free advantage of Mg metal anode in a classic electrolyte. Unfortunately, the team proposed that uneven stripping behavior was inevitable in the chlorine-containing electrolytes, though the chlorine seemed to be beneficial for the plating process.

The team pointed out that the degree of uneven stripping versus the current density displayed a volcano plot. Extremely low or high current density would generate relatively uniform stripping morphology. Furthermore, the team proved that stirring electrolyte and adding leveling agent would improve the stripping behavior.

"The study of Mg metal anode stripping behavior illuminated a non-dendrite-induced Mg battery failure mechanism and provided effective strategies to solve this puzzle," said Prof. Cui Guanglei from QIBEBT.

More information: Xin Liu et al, Uneven Stripping Behavior, A killer of Mg Anode in Mist, *Advanced Materials* (2022). DOI: 10.1002/adma.202201886

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