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ACHIEVEMENTS

# Advancing Battery Technology: The Promise and Challenges of Rechargeable Metal $CO_2$ Batteries

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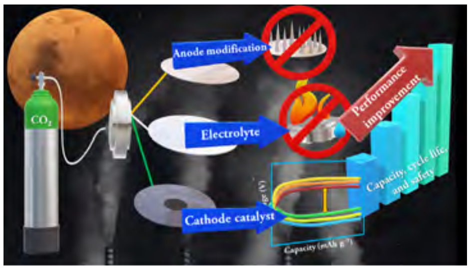
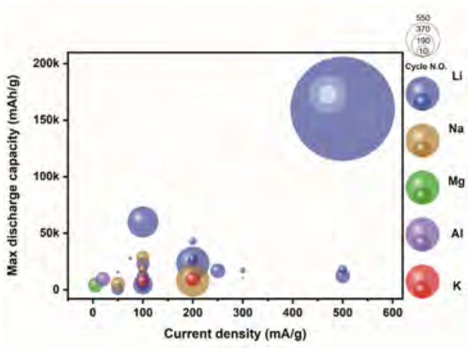
In recent years, the development of rechargeable metal $CO_2$ batteries has attracted considerable attention in the development of sustainable energy solutions and environmental preservation. These innovative batteries, particularly Lithium and Sodium-ion batteries, offer a promising way to mitigate $CO_2$ emissions while powering the electric vehicle industry with their high energy density. Beyond their terrestrial applications, they may also support space exploration, powering rovers on Mars and Venus space missions, and even deployed beneath the sea in submarines. Despite their immense potential, these batteries face some thorny issues, such as a limited life cycle and safety concerns, prompting ongoing research to enhance their performance.



The latest development of rechargeable MCBs with nonaqueous electrolytes.

A collaborative research effort involving Prof. Ru-Shi Liu of NTU's Department of Chemistry and Advanced Research Center for Green Materials Science and Technology, Prof. Chung Ren-Jei of National Taipei University of Technology, and Prof. Shu-Fen Hu of National Taiwan Normal University has produced valuable insights into this technology. Their work, published in Chemical Reviews, delves into the recent advancements in rechargeable metal-$CO_2$ batteries (MCBs), with a particular emphasis on Lithium, Sodium, Potassium, Magnesium, and Aluminum-based variants using nonaqueous electrolytes. The review comprehensively examines the interactions and effects of electrolytes, anodes, and gases on these specific types of MCBs.



A graph showing the current density versus the maximum discharge capacity of different MCBs.

While rechargeable MCBs offer a highly promising, cost-effective energy storage solution, it must be born in mind that these batteries are still in the early stages of development. Substantial research efforts are needed to address the challenges, such as excessive charging–discharging overpotential and limited cyclability, arising from incomplete decomposition and accumulation of insulating and chemically stable compounds. The team's review article provides a comprehensive overview of recent studies, shedding light on key factors influencing the performance of secondary MCBs.

Click or Scan the QR code to read the journal article in *Chemical Reviews*

As the world grapples with the pressing need for sustainable energy solutions, the research conducted by these esteemed professors contributes significantly to our understanding of rechargeable metal $CO_2$ batteries. While there remains much work to be done, these findings light the way for the future of energy storage, offering hope for a more environmentally conscious and energy-efficient world.