frontiers | Frontiers in Energy Research

TYPE Editorial
PUBLISHED 16 July 2024
DOI 10.3389/fenrg.2024.1437511



OPEN ACCESS

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RECEIVED 23 May 2024
ACCEPTED 28 June 2024
PUBLISHED 16 July 2024

CITATION
Luque GL (2024), Editorial: Lithium metal anode protection.
*Front. Energy Res.* 12:1437511.
doi: 10.3389/fenrg.2024.1437511



# Editorial: Lithium metal anode protection

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KEYWORDS

**Li metal batteries, lithium metal anode, protection, solid electrolyte interphase (SEI), dendrite**

Editorial on the Research Topic
Lithium metal anode protection

Lithium metal has long been recognized as a promising candidate as an anode for next-generation high-energy-density batteries due to its high theoretical specific capacity and low electrode potential. However, the practical implementation of lithium metal anodes faces significant challenges related to dendrite formation, electrolyte instability, and safety concerns, which have hindered their widespread adoption. Different strategies can be used to overcome the difficulties associated with the use of lithium metal as an anode in next-generation lithium metal batteries. By addressing the fundamental Research Topic surrounding lithium metal anodes and highlighting breakthroughs in protective technologies, this Research Topic aims to accelerate the development of safe and efficient lithium-based battery systems, bringing together contributions from different groups.

In this Research Topic, Zhang et al. reviewed the advances in the structural design and the selection of the current collectors and their textures for controlled lithium deposition. These authors also presented some of their efforts in realizing controlled lithium deposition by designing current collectors in three aspects, lithium deposition induced by the micro-to-nano structures, lithiophilic alloys, and iron carbides.

Verbrugge et al. clarified the degradation phenomena in a pouch cell that contains an insertion electrode (lithiated NMC622) using lithium metal as a counter electrode finding that cation-mixing is the dominant mechanism for capacity loss in these Li||Ni0.6Mn0.2Co0.2O2 cells.

Carter et al. detected that charging during thermal transients promotes the lithium plating conditions altering the long-term performance and safety of Li-ion batteries. This work exemplifies the importance of understanding the role of thermal transients in pack assemblies to enable safe operation.

Miyazaki reviewed the recent progress of anodes with high capacity for all-solid-state lithium-ion batteries.

Liu et al. reviewed the use of atomic layer deposition as a powerful approach toward 3D solid-state batteries with high-capacity.

I sincerely thank the Editorial Team of Frontiers in Energy Research for their hard work to get the publication of Research Topic. I extend my sincere gratitude to all the authors, reviewers, and contributors who have made this Research Topic possible. I hope that the insights and discoveries presented here will inspire further innovation and progress toward

realizing the full potential of lithium metal as a cornerstone of the next-generation battery technologies.

## Author contributions

GL: Writing–original draft, Writing–review and editing.

## Funding

The author(s) declare that no financial support was received for the research, authorship, and/or publication of this article.

## Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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