

Can Li dendrites be used in solid-state Li metal batteries (SSLMBs)?

However, the problem of lithium (Li) dendrite penetration into LLZO hinders the practical application of LLZO in solid-state Li metal batteries (SSLMBs). Multidisciplinary evaluations are carried out to understand the mechanism of dendrite penetration. Herein, the formation and evolution of different types of Li dendrites within LLZO are reviewed.

What happens if Li dendrites penetrate a SE?

The penetration of Li dendrites in a SE is associated with crack propagation, copious irreversible side reactions, and dead Li [5, 6]. It shortens the cell life, deteriorates the Coulombic efficiency, and finally results in a short circuit [, , ,].

Can a dendrite penetrate a ceramic electrolyte?

However, Li dendrites (filaments) form on charging at practical rates and penetrate the ceramic electrolyte, leading to short circuit and cell failure [3,4]. Previous models of dendrite penetration have generally focused on a single process for dendrite initiation and propagation, with Li driving the crack at its tip [5,6,7,8,9].

Can metal dendrites be deflected in solid-state batteries?

Based upon this principle, we outline design approaches suitable for deflecting metal dendrites in solid-state batteries. Metal-dendrite penetration is a mode of electrolyte failure that threatens the viability of metal-anode-based solid-state batteries.

What is metal-dendrite penetration?

Metal-dendrite penetration is a mode of electrolyte failure that threatens the viability of metal-anode-based solid-state batteries. Whether dendrites are driven by mechanical failure or electrochemical degradation of solid electrolytes remains an open question.

What causes dendrite failure of lithium solid-state batteries?

Analysis of dendrite initiation, owing to filling of pores with lithium by means of microcracks, and propagation, caused by wedge opening, shows that there are two separate processes during dendrite failure of lithium metal solid-state batteries.

Once cycled above the critical current density (CCD), lithium dendrites form and grow towards the cathode to cause short circuit. Additionally, the dendrite penetration process is often accompanied by the fracture of SEs. Many types of SE materials have been reported to suffer from such dendrite penetration [1,2,3,4]. As a result, both the ...

Based on these results, we propose a mechanistic model to explain the preferential growth of lithium dendrites at grain boundaries and their penetration in inorganic ...

Mounting evidence indicates that dendrite penetration is related to the mechanical failure in SSEs, which calls for mechanical engineering to tackle this problem. ... The sandwich-like battery was then put into a CR2032 coin cell case, and the ...

5 ???· The study not only demonstrates a high-performance interfacial-stable lithium metal battery with composite electrolyte but also introduces a novel strategy for real-time visualizing ...

2 Abstract Lithium dendrite penetration through ceramic electrolytes is known to result in mechanical failure and short circuits, which has impeded the commercialization of all-solid-state lithium ...

Solid-state lithium metal batteries (SSLMBs) have attracted a lot of interest owing to their high safety and high energy density potential. However, the growth of lithium dendrite in solid electrolytes still hinders practical applications of SSLMBs. In this study, we develop a simple heat treatment method for reviving and recycling garnet oxide electrolytes ...

We introduce a concept, new to the battery field, for preventing penetration of lithium dendrites through SEs by putting the SE surfaces into a state of residual compressive stress.

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Inhibiting dendrite penetration can be based on suppressing either initiation or propagation, the former by increasing the local fracture strength, as well as minimizing pore size and...

The two biggest promises of solid-state lithium (Li) metal batteries (SSLMBs) are the suppression of Li dendrites by solid-state electrolyte (SSE) and the realization of a high-energy-density Li anode. However, LMBs ...

There are multiple ways a lithium battery can fail, but a longstanding problem associated with high currents is dendrite penetration. Dendrites are tree-like structures that can form on the lithium plating in a ...

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