Anode materials in solid-state batteries

Are anode materials compatible with solid-state batteries?
The review emphasizes the criticality of considering anode materials' compatibility with solid-state batteries (SSBs). It underlines the importance of anode stability in solid-state environments to preserve the integrity of the solid electrolyte and avert degradation.

What are the advantages of alloy anode materials for solid-state batteries?
This perspective discusses key advantages of alloy anode materials for solid-state batteries, including the avoidance of the short circuiting observed with lithium metal and the chemo-mechanical stabilization of the solid-electrolyte interphase.

Are dense alloy anodes suitable for solid-state batteries (SSBs)?
Lithium alloy anodes in the form of dense foils offer significant potential advantages over lithium metal and particulate alloy anodes for solid-state batteries (SSBs). However, the reaction and degradation mechanisms of dense alloy anodes remain largely unexplored.

Why is silicon a good anode material for solid-state batteries (SSBs)?
Silicon is considered an important anode material for solid-state batteries (SSBs) because of its unique properties in addressing key challenges associated with Li metal anodessuch as dendrite formation and morphological instability. Despite many exciting results from previous reports on solid-state Si anod

Why are Si-based anodes important in the development of all-solid-state batteries?
Novel strategic considerations in the development of Si-based anodes are instrumental in the success of all-solid-state batteries in the rapidly changing battery technology landscape.

Can alloy anode materials be used for liquid-based Li-ion batteries?
Alloy anode materials,which have long been investigatedfor liquid-based Li-ion batteries,offer distinct mechanistic benefits for high-performance solid-state batteries and could enable batteries with energy density that is competitive with other high-performance alternatives.

3 ???· Silicon (Si) has attracted significant interest as a promising anode material for all-solid-state batteries (ASSBs) due to its exceptional potential to address safety concerns and enhance energy density. However, despite the difference in configuration between sulfide-based ASSBs and lithium-ion batteries (LIBs), the degradation mechanism of Si anode in both systems ...

Silicon is one of the most promising anode materials due to its very high specific capacity (3590 mAh g -1), and recently its use in solid-state batteries (SSBs) has been proposed. Although SSBs utilizing silicon anodes show broad and attractive application prospects, current results are still in an infant state in terms of electrochemical ...

Here, we investigate the electrochemical lithiation/delithiation behavior of 12 elemental alloy anodes in SSBs with Li 6 PS 5 Cl solid-state electrolyte (SSE), enabling direct behavioral comparisons. The materials show highly divergent first-cycle Coulombic efficiency, ranging from 99.3% for indium to ~20% for antimony.

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In solid-state batteries, carbon-based materials are one of the outstanding anode materials used widely [63], [64]. Graphite is one of the exceptional materials employed for solid-state batteries because of the distinctive layered structure capable of integrating the lithium-ions throughout the Lithiation/delithiation processes.

Nanoengineering has emerged as a critical technique for enhancing anode materials in solid-state batteries. Fuchs et al. demonstrated the potential of carbon nanotubes (CNTs) in composite anodes comprising lithium metal. This study highlighted the transformation of dissolution kinetics from 2D to 3D in the anode, crucial for maintaining contact with the solid ...

Ongoing research efforts are focused on finding appropriate anode materials for all-solid-state Li-ion batteries (ASSLIBs) due to dendrite growth issues in Li-metal anodes. Various alternatives have been proposed, but they also exhibit certain limitations. In this study, we propose a self-stabilizing Sn-based anode.

Failures in solid-state batteries often result from poor contact between active materials and the solid electrolyte due to the volume changes that occur during cycling. To address this issue, this ...

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His research interests focus on in situ transmission electron microscopy characterization of high-capacity electrode materials and solid-state electrolytes for alkali metal ion batteries and solid-state batteries. Xiang Han completed his doctorate degree at Xiamen University in 2019. During 2017-2019, as a joint PhD student, he studied at the ...

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In this review, we first present a systematic introduction to the advancements in Si-based anode materials for all-solid-state lithium batteries. We also explored the characteristics, lithiation ...

Alloy anode materials, which have long been investigated for liquid-based Li-ion batteries, offer distinct mechanistic benefits for high-performance solid-state batteries and could enable batteries with energy density that is competitive with other high-performance alternatives.

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