

High energy density solid-state battery technology

What is a solid-state battery?

A solid-state battery is an electrical battery that uses a solid electrolyte for ionic conduction between the electrodes, instead of the liquid or gel polymer electrolytes found in conventional batteries. Solid-state batteries theoretically offer much higher energy density than the typical lithium-ion or lithium polymer batteries.

What is the difference between lithium ion and solid-state battery energy density?

At a cell level, lithium-ion energy densities are generally below 300 Wh/kg while solid-state battery energy densities are able to exceed 350 Wh/kg. This energy density boost is especially beneficial for applications requiring longer-lasting and more compact batteries such as electric vehicles.

Are solid-state batteries a promising next-generation energy storage device?

Any queries (other than missing content) should be directed to the corresponding author for the article. Abstract Solid-state batteries (SSBs) are regarded as the most promising next-generation energy storage devices due to their potential to achieve higher safety performance and energy density.

What makes a battery a solid state battery?

2. Solid Electrolytes: The Heart of Solid-State Batteries The gradual shift to solid electrolytes has been influenced by the prior development of conventional lithium (Li) batteries, which have traditionally employed liquid electrolytes.

Are solid-state batteries a viable follow-up technology?

As one of the more realistic advancements, the solid-state battery (SSB) recently emerged as a potential follow-up technology with higher energy and power densities being expected, due to the possibility of bipolar stacking, the potential usage of the lithium metal or silicon anode and projected higher device safety.

Why are solid-state lithium-ion batteries (SSBs) so popular?

The solid-state design of SSBs leads to a reduction in the total weight and volume of the battery, eliminating the need for certain safety features required in liquid electrolyte lithium-ion batteries (LE-LIBs), such as separators and thermal management systems [3,19].

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Figure 17 summarizes our model cell calculations and shows a possible development path from the liquid-based state-of-the-art LIB technology to the high-energy all-solid-state battery based ...

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Solid-state batteries with features of high potential for high energy density ...

The cell that has ~3.43 um wetted Li metal with the lowest capacity ratio of negative to positive electrode (~0.176) demonstrates outstanding electrochemical performance. This demonstration will suggest a new direction ...

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Advantages of Solid State Technology. Solid state batteries offer several advantages over traditional lithium-ion batteries. These benefits enhance safety, increase ...

Discover the future of energy storage in our comprehensive article on solid-state batteries. Learn how key players like Toyota, QuantumScape, and Samsung SDI are ...

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OverviewHistoryMaterialsUsesChallengesAdvantagesThin-film solid-state batteriesMakersBetween 1831 and 1834, Michael Faraday discovered the solid electrolytes silver sulfide and lead(II) fluoride, which laid the foundation for solid-state ionics. By the late 1950s, several silver-conducting electrochemical systems employed solid electrolytes, at the price of low energy density and cell voltages, and high internal resistance. In 1967, the discovery of fast ionic conduction ? - alumina for a broad class of ions (Li+, Na+, K+, Ag+, and R...

All-solid-state batteries (ASSBs) using sulfide solid electrolytes with high room-temperature ionic conductivity are expected as promising next-generation batteries, which might solve the safety issues and enable the ...

The worldwide campaign on battery application has entered a high-speed development stage, which urgently needs energy storage technology with high specific ...

At a cell level, lithium-ion energy densities are generally below 300Wh/kg while solid-state battery energy densities are able to exceed 350 Wh/kg. [116] This energy density boost is especially ...

Despite their high theoretical energy density, conversion-type cathode materials face substantial challenges in practical applications. Fig. 1 depicts the conversion reaction of a conversion-type ...

Solid-state battery research has gained significant attention due to their inherent safety and high energy density. Silicon anodes have been promoted for their advantageous characteristics, including high volumetric ...

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Solid-state batteries are a game-changer in the world of energy storage, offering enhanced safety, energy density, and overall performance when compared to traditional ...

Here we report that a high-performance all-solid-state lithium metal battery with a sulfide electrolyte is enabled by a Ag-C composite anode with no excess Li.

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