



# Electrolyte solid-state battery

Solid-state electrolytes (SEs) have attracted great attention due to their advantages in safety, electrochemical stability and battery packaging; especially, they can match with high-voltage cathode materials and the Li metal anode to ...

The battery uses both a solid state electrolyte and an all-silicon anode, making it a silicon all-solid-state battery. The initial rounds of tests show that the new battery is safe, long lasting, and energy dense. It holds promise for a wide range of applications from grid storage to electric vehicles.

This perspective is based in parts on our previously communicated report Solid-State Battery Roadmap 2035+, but is more concise to reach a broader audience, more aiming at the research community and catches up on new or accelerating developments of the last year, e.g., the trend of hybrid liquid/solid and hybrid solid/solid electrolyte use in ...

From the perspective of future development trend, energy issues will always accompany with the human development process. The development of new batteries that are friendly to the environment has become a global trend. Safe solid-state electrolytes with high ionic conductivity, excellent electrochemical property, high mechanical/thermal stability, and good ...

Solid electrolyte is a key component for all-solid-state lithium battery that is one of the most promising technologies for next-generation energy storages. This review describes the challenges and strategies, preparation methods and outlook of ...

Although some solid-state battery prototypes still use ... a deal earlier this month with Japanese petroleum company Idemitsu Kosan, which says it has been working on a sulphide solid electrolyte ...

Typically, a room temperature ionic conductivity of at least  $10^{-4}$  S/cm is required for a practical solid electrolyte (Zhang et al., 2018). The advent of "microbatteries" may utilize electrolytes with reduced thicknesses, such that a conductivity of  $10^{-6}$  S/cm is sufficient (Notten et al., 2007). Furthermore, one must consider the operating frequencies of the potential battery ...

In SSBs, solid-state electrolytes (SSEs) are the key components to enhance the safety concerns significantly with regard to the flammable organic liquid electrolytes in ...

Kitsche, D. et al. High performance all-solid-state batteries with a Ni-rich NCM cathode coated by atomic layer deposition and lithium thiophosphate solid electrolyte. ACS Appl. Energy Mater. 4 ...

What is a solid-state battery? It's a battery that uses a solid electrolyte, instead of a liquid or gel-based one. The electrolyte is that bit in the middle, between the cathode and anode.



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This review summarizes the fundamental issues in solid-state batteries with a focus on three critical phenomena: (i) the principles of developing high ionic conductors, (ii) ...

The solid-state sodium-ion conductor  $\gamma$ -alumina was adopted as the electrolyte for supporting the operation of solid-state cell at room temperature (25 °C) with moderate stacking pressure (ca. 10 ...

An all-solid-state battery with a lithium metal anode is a strong candidate for surpassing conventional lithium-ion battery capabilities. ... K. et al. Interfaces between cathode and electrolyte ...

With the rapid popularization and development of lithium-ion batteries, associated safety issues caused by the use of flammable organic electrolytes have drawn ...

A rocking chair type all-solid-state lithium ion battery adopting  $\text{Li}_2\text{O}$ - $\text{ZrO}_2$  coated  $\text{LiNi}_{0.8}\text{Co}_{0.15}\text{Al}_{0.05}\text{O}_2$  and a sulfide-based electrolyte. *J. Power Sources* 248, 943-950 (2014).

To address these challenges, safe solid-state electrolytes (SSEs) have been proposed and developed. SSEs offer good mechanical strength and wide electrochemical stability windows, and solid-state lithium-ion batteries ...

Nguyen, H. et al. Single-step synthesis of highly conductive  $\text{Na}_3\text{PS}_4$  solid electrolyte for sodium all solid-state batteries. *J. Power Sources* 435, 126623 (2019).

Schlenker, R. et al. Understanding the lifetime of battery cells based on solid-state  $\text{Li}_6\text{PS}_5\text{Cl}$  electrolyte paired with lithium metal electrode. *ACS Appl. Mater. Interfaces* 12, 20012-20025 ...

All-solid-state (ASS) lithium-ion battery has attracted great attention due to its high safety and increased energy density. One of key components in the ASS battery (ASSB) is solid electrolyte that determines performance of the ASSB. ...  $\text{Li}_3\text{N}$  solid electrolyte was prepared by reaction of pure lithium ribbon with nitrogen followed by cold ...

Here we present an integrated solid-state Li-air battery that contains an ultrathin, high-ion-conductive lithium-ion-exchanged zeolite X (LiX) membrane as the sole solid electrolyte.

"In our paper, we outlined the mechanics of materials for solid-state electrolytes, encouraging scientists to consider these when designing new batteries." Reference: "Solid-state batteries: The critical role of mechanics" by Sergiy Kalnaus, Nancy J. Dudney, Andrew S. Westover, Erik Herbert and Steve Hackney, 22 September 2023, *Science*.

Figure 2 terface engineering for solid-state electrolytes. (A) Schematic illustrations with and without ALD interlayer coating on SSE and (B) corresponding SEM images. Reproduced from Han et al. (2017) with permission from Nature Publishing Group. (C) Two-dimensional slices extracted from the three-dimensional



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(3D) tomography of NASICON ...

Abstract Polymer solid-state lithium batteries (SSLB) are regarded as a promising energy storage technology to meet growing demand due to their high energy density and safety. Ion conductivity, interface stability and battery assembly process are still the main challenges to hurdle the commercialization of SSLB. As the main component of SSLB, ...

Solid-state batteries assembled using SSEs are expected to improve the safety and energy density of LIBs. [16, 17] this is due to the good flame retardancy of SSEs and high capacity of Li metal anode addition, a part of the SSEs has ...

Physicochemical and electrochemical characterization of the  $\text{Li}_3\text{PS}_4\text{-}2\text{LiBH}_4$  solid-state electrolyte. The liquid-phase synthesis procedures of LPB SE are illustrated in Supplementary Fig. 5 ...

For example, Zhang et al. reported that PEO/MMT/LiTFSI solid polymer electrolytes demonstrated reinforced Li-ion conductivities in which an optimal electrolyte composed of 10 wt % MMT reached a conductivity of  $3.22 \times 10^{-4} \text{ S cm}^{-1}$  at  $60 \text{ }^\circ\text{C}$  and a corresponding solid-state battery displayed good cycling stability and an acceptable discharge ...

A solid-state battery is a device that converts chemical energy into electrical energy by using solid electrolytes that move lithium ions from one electrode to the other. ... separator between the cathode and the anode to prevent the electrolyte on one side of the battery from mixing with the electrolyte on the other. In solid-state batteries ...

Idemitsu Kosan Co.,Ltd. (Idemitsu) and Toyota Motor Corporation (Toyota) announced today that they have entered into an agreement to work together in developing mass production technology of solid electrolytes, improving productivity and establishment a supply chain, to achieve the mass production of all-solid-state batteries for battery electric vehicles ...

To address these challenges, safe solid-state electrolytes (SSEs) have been proposed and developed. SSEs offer good mechanical strength and wide electrochemical stability windows, and solid-state lithium-ion batteries (SSLIBs) require simplified packaging. Furthermore, the thinness of SSEs allows high-energy-density for SSLIBs.

a The long-term cycling stability test of the solid-state mm-Si electrodes with the elastic electrolyte and  $\text{Li}_6\text{PS}_5\text{Cl}$  electrolyte (green) in the coin-type  $\text{Li}|\text{mm-Si}$  ( $\text{Li-In}|\text{mm-Si}$  for  $\text{Li}_6\text{PS}_5\text{Cl}$  ...

Solid-state batteries based on electrolytes with low or zero vapour pressure provide a promising path towards safe, energy-dense storage of electrical energy.

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