

What materials are used in solid-state batteries?

Recently, the anode materials used in solid-state batteries mainly include graphite, $\text{Li}_4\text{Ti}_5\text{O}_{12}$, silicon, lithium metal, and anode-free. The anode materials used in early SSBs are graphite and $\text{Li}_4\text{Ti}_5\text{O}_{12}$. The preparation method of composite anode is similar to that of the composite cathode, including the dry and wet processes.

Are metal sulfides a good cathode material for all-solid-state batteries?

X. Q. acknowledges the Hong Kong Postdoctoral Fellowship Scheme (PDFS2324-6S07). The authors declare no conflict of interest. Abstract Metal sulfides are increasingly favored as cathode materials in all-solid-state batteries (ASSBs) due to their high energy density, stability, affordability, and conductivity.

What are sulfide-based solid electrolytes?

Sulfide-based solid electrolytes (SEs) are amongst the most promising solid electrolytes for the development of solid-state batteries (SSBs) due to their high ionic conductivity and processing advantage over oxide-based SEs. However, one of the main drawbacks of sulfide SEs is their rapid degradation in presence of humidity.

Can sulfide-based all-solid-state batteries meet EV requirements?

As discussed in Sections 4 Interfacial problems in sulfide-based all-solid-state batteries and solutions, 5 Transport and mechanical issues in composite electrodes, we believe that overcoming the transport limitations at the interface and composite electrode levels will help boost the rate performance of ASSBs to meet the EVs' requirements.

Can sulfide-based all-solid-state batteries be scaled up?

Scaling up sulfide-based all-solid-state batteries Currently, most sulfide-based ASSBs are constructed of stacking pellet-type electrodes and thick SE layers. However, the fabrication of pellet-type ASSBs is time-consuming and discontinuous, and can hardly be scaled up.

Can sulfide/polymer composite based solid-state electrolytes be used in lithium batteries?

The sulfide/polymer composite based solid-state electrolyte can be utilized in lithium metal or lithium sulfur batteries. However, there are still many problems left to be solved in practical applications of these solid-state electrolytes. In this review, several solutions are explored.

Our focus will primarily be on the critical developments in solid electrolytes and anode materials for solid-state batteries (SSBs), with a special emphasis on lithium-metal anodes and their interfaces, elucidating the innovative strides in this particular area of energy storage technology. 1.2. Advancements and Concepts of Solid-State Batteries (SSBs) Solid-state ...

All-solid-state batteries (ASSBs) are regarded as the most promising next-generation batteries for electric

vehicles in virtue of their potential advantages of enhanced safety, high energy density and power capability. Among the ASSBs based on various solid electrolytes (SEs), sulfide-based ASSBs have attracted increasing attention due to the ...

Sulfide all-solid-state batteries (ASSBs) have been widely acknowledged as next-generation energy-storage devices due to their improved safety performance and potentially high energy density. Among the various ...

A possible method to simultaneously improve Li/sulfide interfacial contact and avoid lithium-dendrite nucleation is to introduce fast ion/electron mix-conducting liquid metal interlayers/anodes [13], such as molten alkali metals and fusible liquid alloy. These lithiophilic liquid materials can create intimate interfacial contact and prevent dendrite nucleation/related ...

The commercialization of sulfide solid-state batteries necessitates addressing a multitude of challenges across various domains. By focusing research and development efforts on enhancing material stability, optimizing interfaces, refining electrode fabrication and cell designs, streamlining manufacturing processes, reducing costs, improving ...

In batteries with solid-solid interfaces, mechanical contacts, and the development of stresses during operation of the solid-state batteries, become as critical as the electrochemical stability to keep steady charge transfer at these interfaces. This review will focus on stress and strain that result from normal and extended battery cycling and the associated ...

Solid electrolytes are recognized as being pivotal to next-generation energy storage technologies. Sulfide electrolytes with high ionic conductivity represent some of the most promising materials to realize high-energy-density all-solid-state lithium batteries. Due to their soft nature, sulfides possess good wettability against Li metal and their preparation process is relatively effortless.

Lithium-sulfur batteries with liquid electrolytes have been obstructed by severe shuttle effects and intrinsic safety concerns. Introducing inorganic solid-state electrolytes into lithium-sulfur systems is believed as an effective approach to eliminate these issues without sacrificing the high-energy density, which determines sulfide-based all-solid-state ...

In addition, the application of liquid-phase synthesized sulfide solid electrolytes for all-solid-state lithium batteries is presented from six aspects: sulfide electrolytes coated on active materials, electrolyte-active material composites, electrolyte injection into porous electrodes, interfacial modification at solid-solid contact triple ...

The liquid-phase synthesis of sulfide SEs holds significant importance in sulfide solid-state battery technology, ... Additionally, its versatility and scalability accommodate various sulfide materials, enabling tailored production of sulfide SEs for specific applications. Lastly, ball milling generally has a lower cost compared to traditional high-temperature ...

Solid-state battery sulfide materials

Metal sulfides are increasingly favored as cathode materials in all-solid-state batteries (ASSBs) due to their high energy density, stability, affordability, and conductivity. Metal sulfides often exhibit capacities exceeding their theoretical limits, a phenomenon that remains not fully understood.

All-solid-state batteries (ASSBs) are considered to be a next-generation energy storage concept that offers enhanced safety and potentially high energy density. The identification of solid electrolytes (SEs) with high ionic conductivity was ...

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Sulfide-based solid electrolyte films with high room-temperature ionic conductivity will boost the energy density of all-solid-state batteries. This Review covers the preparation...

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 utilization of lithium metal as the anode to further increase the energy density of cells. Most researchers in the academic ...

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