

# Carbothermal reduction all solid state batteries

Can carbothermal reduction of lithium sulfate purify rough Li<sub>2</sub>S materials?

Herein, a novel approach for the preparation of Li<sub>2</sub>S through carbothermal reduction of lithium sulfate (Li<sub>2</sub>SO<sub>4</sub>) is designed and optimized. Two novel strategies for purifying rough Li<sub>2</sub>S materials are proposed in this work. A low raw material cost of \$148 kg<sup>-1</sup> and a high yield of 88.50 % are achieved.

Do solid-state electrolyte reduction and Li dendrite growth limit the stability of lithium batteries?

Solid-state electrolyte reduction and Li dendrite growth limit the stability of all-solid-state Li metal batteries.

Are Lithium sulfide (Li<sub>2</sub>S) solid electrolytes suitable for all-solid-state lithium batteries?

High capacity and long life of ASSLBs are obtained. Lithium sulfide (Li<sub>2</sub>S) is a key raw material for synthesizing sulfide solid electrolytes (SSEs), which has been considered as one of the most promising solid electrolytes for all-solid-state lithium batteries (ASSLBs). However, the high cost of Li<sub>2</sub>S limits the development of SSEs.

Can solid reductive-electrophile interphase tailoring accelerate all-solid-state lithium metal battery commercialization?

Such solid reductive-electrophile interphase tailoring of material surfaces holds promise to accelerate all-solid-state lithium metal battery commercialization and offer solutions for a wide range of materials. All-solid-state Li metal batteries (ASSLMBs) offer high levels of energy density and safety in transportation electrification.

Are lithium battery chemistries enabled by solid-state electrolytes?

Manthiram, A., Yu, X. & Wang, S. Lithium battery chemistries enabled by solid-state electrolytes. *Nat. Rev. Mater.* 2, 16103 (2017). Egerton, R. F. *Electron Energy-Loss Spectroscopy in the Electron Microscope* (Springer Science & Business Media, 2011).

Are all-solid-state rechargeable lithium batteries a positive electrode material?

All-solid-state rechargeable lithium batteries with Li<sub>2</sub>S as a positive electrode material. *J. Power Sources* 183, 422-426 (2008). Kwok, C. Y., Xu, S., Kochetkov, I., Zhou, L. & Nazar, L. F. High-performance all-solid-state Li<sub>2</sub>S batteries using an interfacial redox mediator. *Energy Environ. Sci.* 16, 610-618 (2023).

Lithium sulfide with low cost and high yield was prepared by carbothermic reduction of lithium sulfate and applied to all-solid-state batteries. Download: Download high ...

Such solid reductive-electrophile interphase tailoring of material surfaces holds promise to accelerate all-solid-state lithium metal battery commercialization and offer solutions ...

Sodium super ion conductor (NASICON) structure materials, known for fast diffusion channels for Na<sup>+</sup>, are promising solid electrolyte materials for sodium-ion batteries ...

The research on ASSLSBs faces not only the interfacial challenges in general (as with all all-solid-state lithium batteries) but also the sluggish SSSRR and large volume ...

This contribution describes the development and adaptation of the synthesis of Li<sub>2</sub>S via carbothermal reduction of lithium sulfate (Li<sub>2</sub>SO<sub>4</sub>). The molar ratio of the starting reagents ...

Abstract Lithium sulfide (Li<sub>2</sub>S) is the critical raw material used for the synthesis of sulfide solid-state electrolytes, but its high cost and pollution restrict the commercialization of ...

Sulfide solid electrolytes are promising materials for next-generation all-solid-state lithium batteries due to their high ionic conductivity, mechanical properties, and compatibility with ...

As a mature and well-understood technique, carbothermal reduction remains a best choice for large-scale production of lithium sulfide, combining economic and ...

Such solid reductive-electrophile interphase tailoring of material surfaces holds promise to accelerate all-solid-state lithium metal battery commercialization and offer solutions for a wide range ...

The smaller numerical value of the diameter of Fig. 6 Cyclic voltammograms of the LiFePO<sub>4</sub>/C samples prepared by the modified and ordinary solid state carbothermal ...

This contribution describes the development and adaptation of the synthesis of Li<sub>2</sub>S via carbothermal reduction of lithium sulfate (Li<sub>2</sub>SO<sub>4</sub>). The molar ratio of the starting ...

The sulfide solid electrolyte synthesized via carbothermal reduction of lithium sulfate for solid-state lithium-sulfur batteries ...

Abstract Lithium sulfide (Li<sub>2</sub>S) is the critical raw material used for the synthesis of sulfide solid-state electrolytes, but its high cost and pollution restrict the commercialization of sulfide solid-state electrolytes and sulfide ...

Lithium sulfide (Li<sub>2</sub>S) is a critical material for clean energy technologies, i.e., the cathode material in lithium-sulfur batteries and the raw material for making sulfide solid electrolytes in all-solid-state batteries. ...

New approaches for Na<sub>2</sub>S/C cathode fabrication employing carbothermal reduction of Na<sub>2</sub>SO<sub>4</sub> at varying temperatures (660 to 1060 °C) are presented.

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This process, which involves reducing metal elements within spent batteries using carbon (C)-containing substances such as graphite or lignite, plays a pivotal role in ...

Dive into the research topics of "The sulfide solid electrolyte synthesized via carbothermal reduction of lithium sulfate for solid-state lithium-sulfur batteries".

The improper disposal of spent lithium batteries, containing valuable metals, poses environmental risks, necessitating efficient recycling methods. In-situ carbothermal ...

Lithium sulfide ( $\text{Li}_2\text{S}$ ) is an important and expensive reagent extensively used for the lithium-sulfur (Li-S) electrochemical systems. Especially, it is a basic reagent for the sulfide ...

The results obtained can help to optimize the parameters in the industrial processing already used for Li-ion battery recycling, especially if followed by hydrometallurgical treatment.

A sodium-ion cell based on the fluorophosphate compound  $\text{NaVPO}_4\text{F}$  [J]. *Electrochemical and Solid-State Letters*, 2003, 6: A1-A4. Article Google Scholar SONG Wei ...

The results obtained can help to optimize the parameters in the industrial processing already used for Li-ion battery recycling, especially if followed by hydrometallurgical ...

Herein, a novel approach for the preparation of  $\text{Li}_2\text{S}$  through carbothermal reduction of lithium sulfate ( $\text{Li}_2\text{SO}_4$ ) is designed and optimized. Two novel strategies for ...

Samples of  $\text{Li}_4\text{Ti}_5\text{O}_{12-y}$  solid solutions are synthesized by one-step solid-state carbothermal reduction reaction using  $\text{Li}_2\text{CO}_3$ , anatase, and carbon black under a nitrogen atmosphere.

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