

What are the advantages of germanium based materials?

(Data source: Web of Science,23-April-2020). In addition to the high theoretical capacity,germanium-based materials have many other obvious advantages. 1) High lithium-ion diffusivity.

Are germanium-based materials a potential anode for lithium ion batteries?

Germanium-based materials with extremely high theoretical energy capacities have gained a lot of attention recently as potential anodes for lithium ion batteries.

What are the advantages of germanium based anode materials?

Compared with other IV group element, germanium anode materials have many unique features. More details are shown in Table 1. It is believed that germanium-based anodes could meet the increasing requirements for batteries with high power and energy densities.

Why is germanium anode important in lithium-ion batteries?

Use the link below to share a full-text version of this article with your friends and colleagues. The germanium (Ge) anode attains wide attention in lithium-ion batteries because of its high theoretical volumetric capacity(8646 mAh cm<sup>-3</sup>). However,the huge volume expansion (?230%) results in its poor electrochemical performances.

Are germanium-based anodes suitable for lithiation?

Germanium-based materials for LIBs have been demonstrated to possess ultrafast charge-discharge rate, high stability and robustness after lithiation. Several reviews focused on germanium-based anodes have been published recently [ , , , , ].

Could amorphization boost the lithium storage capacity of germanium selenides?

The capacity of 1100 mA h g<sup>-1</sup> is maintained over 180 cycles at a current density of 0.1 A g<sup>-1</sup>. In germanium selenides,it is also found by ex-situ XRD and Raman spectroscopy characterization that the production and amorphization of cubic/ST12-phase Ge could boost its lithium storage capacity.

Nanostructured germanium is a promising material for high-performance energy storage devices. However, synthesizing it in a cost-effective and simple manner on a large scale remains a significant challenge. Herein, we report a redox-transmetalation reaction-based route for the large-scale synthesis of mesoporous germanium particles from germanium oxide at temperatures of ...

Nanostructured germanium is a promising material for high-performance energy storage devices. However, synthesizing it in a cost-effective and simple manner on a large scale remains a significant ...

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The Cu-Ge alloy exhibited significant potential as a latent heat storage material in next-generation solar thermal power plants because it demonstrates various advantages, including a superior ...

Germanium, a promising electrode material for high-capacity lithium ion batteries (LIBs) anodes, attracted much attention because of its large capacity and remarkably fast charge/discharge kinetics. Multivalent-ion batteries are of interest as potential alternatives to LIBs because they have a higher energy density and are less prone to safety hazards. In this ...

The development of materials for energy storage hinges on the design of electrodes with large capacity, flexibility, fast charge-discharge rate and long cycling lifetime. Here, the authors ...

Germanium is a highly promising anode material for lithium-ion batteries as a consequence of its large theoretical specific capacity, good electrical conductivity, and fast ...

Exploring prospective materials for energy production and storage is one of the biggest challenges of this century. ... Lead-free germanium iodide perovskite materials for photovoltaic application ...

DOI: 10.1016/J.PARTIC.2014.03.003 Corpus ID: 100015945; Thermal energy storage: Challenges and the role of particle technology ? @article{Ge2014ThermalES, title={Thermal energy storage: Challenges and the role of particle technology ?}, author={Zhiwei Ge and Yongliang Li and Dacheng Li and Ze Sun and Yi Jin and Chuanping Liu and Chuan Li and ...

Energy Storage Materials. 33.0 CiteScore. 18.9 Impact Factor. Articles & Issues. About. Publish. Order journal. Menu. Articles & Issues. Latest issue; ... select article Hollow germanium nanocrystals on reduced graphene oxide for superior stable lithium-ion half cell and germanium (lithiated)-sulfur battery.

Increasing concerns about the vulnerability of the world's energy supply and the necessity to implement sustainable technologies have prompted researchers to develop high-performance electrocatalysts that are affordable and efficient for converting and storing renewable energy. This article reports a facile approach to fabricating two-dimensional (2D) Ge-decorated ...

The biggest challenge for germanium-based materials as commercial anodes for lithium storage is to reduce the costs without sacrificing the electrochemical activity of ...

Ge-CDY delivers ultrahigh theoretical and measured specific capacity (2701 and 2340 mA h g<sup>-1</sup>) and achieves extraordinary electrochemical energy storage performance in LIBs such as ultralong cycling stability and superior rate capability, indicating Ge-CDY is a promising anode material with great potential for practical energy device.

Many researchers are mitigating the effects of volume expansion by modifying the structure of germanium-based anode materials. Zeng's group prepared a Ge/GeO<sub>2</sub>-OMC composite serving as an anode material, exhibiting remarkable cycling stability, retaining a battery capacity of 1018 mAh g<sup>-1</sup> even after undergoing 100 cycles at a current density of 100 mA g<sup>-1</sup> [12].

Amorphous Ge nanoparticles with the particle size of ~10 nm were prepared by capping butyl groups and were characterized using XAS, TEM, FT-IR reflectance, and electrochemical cycling. The XAS results for the first-cycle Ge nanoparticles exhibited either a little particle aggregation after reformation of the Ge-Ge metallic bond or reformation of Ge-Ge metallic bond followed ...

Thermal energy storage by solid-liquid phase change is one of the main energy storage methods, and metal-based phase change material (PCM) have attracted more and more attention in recent years due to their high energy storage density and high thermal conductivity, showing unique advantages in thermal energy storage system and temperature ...

Germanium-based materials are arousing increasing interest as anodes for lithium-ion batteries, stemming from the intrinsic physical and chemical advantages of germanium. This progress report provides a brief review on the current development of germanium-based materials in lithium storage. The state-of-the-art strategies to achieve enhanced ...

This technology is involved in energy storage in super capacitors, and increases electrode materials for systems under investigation as development hits [[130], [131], [132]]. Electrostatic energy storage (EES) systems can be divided into two main types: electrostatic energy storage systems and magnetic energy storage systems.

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Therefore, the evolution of smart grids by using stationary energy storage systems (ESSs) has aroused great interests worldwide. Because of their advantages like high energy/power energy, wide operating temperature range, no ... [35]; another type of anode materials is based on alloying reaction, such as Si-based materials, Ge, and Sn [36], ...

Germanium (Ge) is a promising candidate material for the high-capacity anode of LIBs. Although the cost of Ge is the main barrier for its wide application in large-scale electrochemical energy storage, the electrochemical performance of Ge in LIBs is interesting from both scientific and engineering perspectives. Compared to silicon (Si), Ge has ...

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Advanced Energy Materials is your prime applied energy journal for research providing solutions to ... the development of germanium-based materials to make a breakthrough in commercial application and keep a foothold for germanium in energy storage devices. Acknowledgements. Financial support provided by the Australian Research Council (ARC ...

A copper-germanium alloy (Cu-Ge alloy) was examined as a phase change material, at temperatures exceeding 600°C, for latent heat storage in solar thermal applications. First, the thermo-physical properties of the Cu-Ge alloy were examined using differential scanning calorimetry, thermomechanical analysis, and laser flash analysis. Second, to evaluate the ...

In this study, an iron-germanium alloy (Fe-Ge alloy) was examined as a phase change material at temperatures exceeding 800°C for thermal energy storage in solar thermal applications. The cyclic properties of the thermal charge/discharge of the Fe-Ge alloy were examined at various thermal cycles.

Abstract The germanium (Ge) anode attains wide attention in lithium-ion batteries because of its high theoretical volumetric capacity (8646 mAh cm<sup>-3</sup>). ... Advanced Energy Materials. Volume 14, Issue 31 2401065. Research Article. ... Shenzhen Key Laboratory of Advanced Energy Storage, Department of Mechanical and Energy Engineering, Southern ...

Fully bulk utilization of electrode materials is one of holy grails for electrochemical energy storage due to its potential to maximize specific capacitance (C s). ... A 3D well-defined porous material germanium-carbdiyne (Ge-CDY) comprised only with sp-hybridized carbon atoms bridged by Ge atoms has been synthesized and investigated. ...

Germanium (Ge) is a promising candidate material for the high-capacity anode of LIBs. Although the cost of Ge is the main barrier for its wide application in large-scale electrochemical energy ...

The need for energy storage materials that offer high energy density, rapid charging, long-lasting performance, and portability has experienced a substantial rise in the past few years. ... Ge films prepared through E-beam evaporation can be lithiated to form Li<sub>15</sub>Ge<sub>4</sub>, while in the case of carbon-coated Ge materials, Li<sub>22</sub>Ge<sub>5</sub> is detected at ...

In the present work, we report a new lithium-niobium germanate LiNbGeO<sub>5</sub> material as the anode material for LIBs in which the in situ formed intermediate LiNbO<sub>3</sub> with high ...

NPG Asia Materials - Three-dimensional ordered porous materials can improve the electrochemical storage of energy. Jing Wang and Yuping Wu from Nanjing Tech University, China and co-workers review ...

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of core-shell nanostructure to protect and accelerate sulfur conversion reaction" Energy Storage Materials 60 (2023) 102818. Jae Ho Kim, Dong Yoon Park, Jae Seo Park, Minh Shin, ... Seung Jae Yang. Article 102854 View PDF; Previous ...

Energy Storage Materials. Volume 18, March 2019, Pages 59-67. ... (LLZTO) or  $\text{Li}_{1.5}\text{Al}_{0.5}\text{Ge}_{1.5}(\text{PO}_4)_3$  (LAGP), is expected to obtain high  $t_+$ . It can not only conduct the  $\text{Li}^+$  along the interface and polymer chain but provide the  $\text{Li}^+$  pathway through the bulk phase.

Germanium-based nanomaterials have emerged as important candidates for next-generation energy-storage devices owing to their unique chemical and physical properties. In this Review, ...

In this study, an iron-germanium alloy (Fe-Ge alloy) was examined as a phase change material at temperatures exceeding  $800^\circ\text{C}$  for thermal energy storage in solar thermal applications.

Welcome back to Critical Materials 101, a video series breaking down the building blocks of our clean energy future. In this second installment, we investigate what it takes to turn these foundational elements and components into the clean energy technologies needed to reach our goal of achieving a net zero emissions economy by 2050.

Copper-Germanium Alloy as Solar Latent Heat Storage at High Temperatures. Front. Energy Res. 9:696213. doi: 10.3389/fenrg.2021.696213 Frontiers in Energy Research | 1 June ...

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