

Solar Silicon Nanowire Lithium Battery



Overview

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Due to their unique structural, electrical, optical, and thermal properties, silicon nanowires (SiNWs) are attracting immense interest as a promising material for advanced energy conversion and storage applications. In this feature article, we review the recent achievements on SiNWs for advanced energy conversion and storage applications including. Silicon nanowire Photovoltaics Photocatalysis Thermoelectrics Lithium-ion battery Supercapacitor Silicon is currently the most dominant functional material for commercial electronic applications due to the following beneficial features: (1) the second most abundant element on Earth; (2) high stability and non-toxicity; (3) high carrier mobility; and (4) well-established fabrication technique. In recent years, low-dimensional silicon nanostructures have been extensively studied as nanoscale building blocks for high-performance electronic and photonic devices in light of their attractive physical and chemical properties that are different from those of bulk silicon,,,,,,,,,,,,,. Among low-dimensional silicon nanostructures, silicon nanowires (SiNWs) possess unique structural, electrical, optical, and thermoelectric properties. SiNWs are thus regarded the most attractive candidate for various device applications such as high-performance transistors,,,,,, ultrahigh sensitivity chemical/biological sensors,,,,,, cost-efficient photovoltaic devices,,,,,, low-cost thermoelectric devices,, and high-capacity lithium-ion rechargeable batteries,. To meet the world's growing energy demand and fast-growing market for portable electronic devices, such as cell phones and laptops, significant advances in energy conversion and storage technologies are urgently needed. The properties of SiNWs strongly depend on their preparation methods, ; therefore the fabrication methods of SiNWs with controlled properties are extremely important, and the research efforts in the field have primarily focused on the fabrication of SiNWs for technological applic...

Article Content

Solid-liquid-solid growth of doped silicon nanowires for high ...

Solid-liquid-solid growth of doped silicon nanowires for high-performance lithium-ion battery anode Author links open overlay panel Jiawen Li a 1, Tongde Wang a 1, Yajie Wang b 1, Zhihang Xu c 1, Abdul Mateen a, Wei Yan a, Haojie Li a, Altaf Mujear a, Jing Chen a, Shengyuan Deng a, Guohua Gao a, Changlin Zheng b, Ye Zhu c, Zengfeng ...

Silicon could make car batteries better—for a price

Silicon can store far more energy than graphite—the material used in the anode, or negatively charged end, of nearly all lithium-ion batteries. Silicon-dominant anodes are used in niche ...

Nanowire Electrodes for Advanced Lithium Batteries

Besides, ultralong LiV_3O_8 nanowires have been synthesized by topotactic lithiation of $\text{H}_2\text{V}_3\text{O}_8$ nanowires (Xu et al., 2012). The LiV_3O_8 nanowire cathode showed excellent high-rate capability and cycling stability. The excellent performance can be attributed to the low-charge-transfer resistance, good structural stability, large surface area, and suitable ...

Silicon nanowire

Schematic of silicon nanowire. Silicon nanowires, also referred to as SiNWs, are a type of semiconductor nanowire most often formed from a silicon precursor by etching of a solid or through catalyzed growth from a vapor or liquid phase. Such nanowires have promising applications in lithium-ion batteries, thermoelectrics and sensors. Initial synthesis of SiNWs is ...

Airbus partners with Amprius, leader in high energy density battery ...

The company's products and technology platforms include a 100% silicon nanowire anode, silicon-graphite composite anodes, lithium-rich cathodes, and high voltage electrolytes tailored for silicon. "We are extremely pleased to be working with Airbus and supplying batteries for the Zephyr program," said Jon Bornstein, COO of Amprius.

Silicon nanowires for rechargeable lithium-ion battery anodes

Large-area, wafer-scale silicon nanowire arrays prepared by metal-induced chemical etching are shown as promising scalable anode materials for rechargeable lithium battery.

Silicon enabled energy storage with extreme energy and ...

The Amprius Solution to Silicon Anode Expansion SILICON SURFACE SILICON COATING COATING SILICON NANOWIRE TEMPLATE SUBSTRATE SideView 100% Silicon Nanowires Allow Volume Expansion without Binders, Graphite or any Inactive Materials Conventional Graphite (and/or Silicon) Particles Silicon Nanowires •Spacing between ...

Amprius Set to Showcase State-of-the-Art Silicon Nanowire Battery ...

Amprius to Host Ribbon Cutting Ceremony at Its Fremont CA Headquarters for the New MWh Silicon Nanowire Battery Production Line. FREMONT, Calif.--(BUSINESS WIRE)-- Amprius Technologies, Inc. ("Amprius" or the "Company") (NYSE: AMPX), a leader in next-generation lithium-ion batteries with its Silicon Anode Platform, today announced it is hosting ...

The All-New Amprius 500 Wh/kg Battery Platform is Here

Amprius Technologies, Inc. is a leading manufacturer of high-energy and high-power lithium-ion batteries producing the industry's highest energy density cells. The Company's corporate headquarters is in Fremont, California where it maintains an R& D lab and a pilot manufacturing facility for the fabrication of silicon nanowire anodes and cells.

High Energy Density and Specific Energy Batteries with ...

Amprius Technologies Snapshot 2 • TECHNICAL LEADERSHIP: Amprius is a pioneer and the established leader in silicon anode materials and high energy density lithium ion batteries. • BEST PERFORMANCE: Amprius has the highest energy density lithium ion cells in use in the world based on 100% Silicon nanowire anode technology. • COMPREHENSIVE PLATFORM: ...

The All-New Amprius 500 Wh/kg Battery Platform is Here

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Silicon nanowires for advanced energy conversion and storage

In 2008, Garnett et al. fabricated n-p core-shell silicon nanowire solar cells by coating p-type silicon film onto n-type MCEE SiNW arrays ... SiNWs have shown great potential as lithium-ion battery anodes, due to silicon's highest storage capacity for lithium, excellent stress accommodation for reversible lithiation and delithiation, and ...

Catalyst-free synthesis of sub-5 nm silicon nanowire arrays with ...

A review on silicon nanowire-based anodes for next-generation high-performance lithium-ion batteries from a material-based perspective. Sustain. Energy Fuels 4, 1577–1594 (2020).

Solid-liquid-solid growth of doped silicon nanowires for high ...

In addition, the prepared Sn-doped SiNWs as the anode material in lithium-ion batteries exhibit excellent performance with a high initial Coulombic efficiency of 85.4 %, and a ...

Utilization of Silicon for Lithium-Ion Battery Anodes: Unveiling ...

Abstract Within the lithium-ion battery sector, silicon (Si)-based anode materials have emerged as a critical driver of progress, notably in advancing energy storage capabilities. The heightened interest in Si-based anode materials can be attributed to their advantageous characteristics, which include a high theoretical specific capacity, a low delithiation potential, ...

Partnership with Airbus Defence and Space | Amprius

The company's products and technology platforms include a 100% silicon nanowire anode, silicon-graphite composite anodes, lithium-rich cathodes, and high voltage electrolytes tailored for silicon. "We are extremely pleased to be working with Airbus and supplying batteries for the Zephyr program," said Jon Bornstein, COO of Amprius.

Nanowire battery

A nanowire battery uses nanowires to increase the surface area of one or both of its electrodes, which improves the capacity of the battery. Some designs (silicon, germanium and transition metal oxides), variations of the lithium-ion battery have been announced, although none are commercially available. All of the concepts replace the traditional graphite anode and could ...

High-performance lithium battery anodes using silicon nanowires

Here, we show that silicon nanowire battery electrodes circumvent these issues as they can accommodate large strain without pulverization, provide good electronic contact ...

Amprius Technologies Silicon Anode Batteries

At approximately half the weight and volume of state-of-the-art, commercially available lithium-ion cells, the all-new battery cell delivers potential industry-disrupting performance with barrier ...

A review on silicon nanowire-based anodes for next ...

The lithium-ion battery (LIB) is an efficient electrochemical energy storage device with high voltage, long life, good safety, etc. Silicon has a high theoretical specific capacity (4200 mA h g⁻¹), due to which it is considered a promising anode ...

TIP Project Brief 090052 Silicon Nanowire Production for ...

Amprius has demonstrated anodes made of silicon nanowires that are tolerant of strains and can expand and contract without breaking for hundreds of cycles. A practical battery with a silicon ...

Amprius Technologies Awarded U.S. Army Contract to Develop 100% Silicon ...

FREMONT, Calif., Oct. 12, 2021 /PRNewswire/ -- Amprius Technologies, Inc., the performance leader in Silicon Anode Li-Ion Batteries via their Si-Nanowire™ platform, today announced a contract award with the U.S. Army's Rapid Capabilities and Critical Technologies Office (RCCTO).. The contract, an 18-month rapid prototyping effort, includes the design, ...

High Energy Density Lithium-Ion Cells with Silicon Nanowire ...

Operating temperature range: - 20oC to 55oC. Cycle life 150-300 cycles, depending on operating conditions. "The aircraft has achieved an altitude of 74,000 ft in Arizona and, critically, has ...

Amprius" silicon nanowire lithium ion batteries power Airbus ...

Amprius, Inc., a leading manufacturer and developer of high energy and high capacity lithium-ion batteries, announced today that the company is supplying advanced lithium ion cells to the Airbus Defence and Space Zephyr Program.. Using Amprius" cells, which contain a 100% silicon anode, the Zephyr S flew more than 25 days, setting a new endurance and ...

Our Batteries Power Airbus Zephyr Aircraft | Amprius

Amprius" Silicon Nanowire Lithium Ion Batteries Are Powering the Airbus Zephyr S HAPS Solar Aircraft. The Zephyr platform is a new class of unmanned air vehicle that ...

Vertically Aligned n-Type Silicon Nanowire Array as a Free ...

Keywords: silicon nanowire, nanowire array, silicon anode, n-type silicon anode, Li-ion battery. 1. Introduction. Lithium-ion batteries (LIBs) are among the most robust energy storage devices due to their good cycle life, low self-discharge, and high energy density [1,2].

Silicon-based lithium-ion battery anodes and their application in ...

With new possibilities, silicon and silicene nanocomposites, especially with safe solid-state superionic conductors, would be important for many solid-state electronic and energy generating devices, e.g., all-solid-state lithium-ion, metal-air, or lithium-air batteries, and dye-sensitized solar cell-Li-ion battery hybrids.

(PDF) Properties of silicon-based lithium batteries with different ...

Production of high-aspect-ratio silicon (Si) nanowire-based anode for lithium ion batteries is challenging particularly in terms of controlling wire property and geometry to improve the battery ...

Nanowire Lithium-Ion Batteries Power Airbus Zephyr ...

Combining solar power and lithium-ion batteries, the Zephyr aircraft holds world records for endurance as well as altitude, flying at 70,000 feet or higher. This stratospheric platform can fly for months at a time and ...

Contact Us

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