



Porous silicon structure battery

A tandem structure of porous silicon film on single-walled carbon nanotube (SWNT) film is presented to significantly improve the cycling stability of silicon as lithium-ion battery anode material and will provide a powerful means for the development of lithium-ion batteries. Development of materials and structures leading to high energy and power density ...

Additionally, the porous carbon structures' inherent tunability means we can meet different silicon content needs with relative ease, adjusting for capacity and cycle stability control. Furthermore, having a carbon-silicon interface allows for good electronic conductivity, which is important for rate capability (an ability to generate a ...

Uniform porous silicon hollow nano-spheres are prepared without any sacrificial templates through a magnesiothermic reduction of mesoporous silica hollow nanospheres and surface modified by the following in situ chemical polymerization of polypyrrole. The porous hollow structure and polypyrrole coating contribute significantly to the excellent structure stability and ...

Hierarchical porous silicon structures with extraordinary mechanical strength as high-performance lithium-ion battery anodes

Zhao Y, Liu X, Li H, Zhai T, Zhou H (2012) Hierarchical micro/nano porous silicon Li-ion battery anodes. Chem Commun 48:5079-5081. Article CAS Google Scholar Zheng H, Fang S, Tong ZK, Dou H, Zhang XG (2016) Porous silicon@Polythiophene core-shell nanospheres for lithium-ion batteries. Part Part Syst Charact 33:75-81

2.1 Experimental design. Among the many methods for preparing porous silicon, electrochemical anodic corrosion is widely used because of its speed and simplicity. In the etching process of porous silicon, electrolyte and current density, etching time will affect the surface morphology of porous silicon, and there have been many studies on these parameters, which ...

Three types of porous silicon structures. (a) SEM images of the inverse opal structure from 890 nm pre-sintered silica ... Hierarchical micro/nano porous silicon Li-ion battery. anodes Chem ...

Developing robust micron porous silicon (MPSi) anodes has received much attention for next-generation lithium (Li)-ion batteries. Nevertheless, localized high stresses during fabrication and cycling tremendously bring about structural failure and capability degradation. Herein, a flexible-rigid covalent nano

A dynamic magnesiothermic reduction (DMR) of various silica having different size and porosity is conducted to study the effects of silica properties on the i) DMR reaction ...

To address these problems existed for applications, nanostructured silicon materials, especially Si-based



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materials with three-dimensional (3D) porous structures have received extensive attention ...

Additionally, the porous carbon structures' inherent tunability means we can meet different silicon content needs with relative ease, adjusting for capacity and cycle stability control. Furthermore, having a carbon-silicon interface allows for good ...

For lithium-ion batteries, a porous silicon electrode was prepared through electrochemical etching on a wafer with a hydrofluoric acid (HF) etching solution at a constant current density. The ...

First, we perform the global structure search based on Particle Swarm Optimization (PSO) algorithm as implemented in the CALPSO code [26] to find all the possible 3D structures of LiC_2Si within a supercell containing 24 atoms (corresponding to six formulae) with lower energy and porous C_2Si frame, three of which are shown in Fig. 1 (a-c). Fig. 1 (a) is the ...

Figure 1. (a) Schematic diagram of a porous silicon structure. (b) One unit of the porous structure used for theoretical simulation and analysis. (c) Pore size before and after lithiation and (d) corresponding maximum stress at fixed pore-to-pore distance ($l = \dots$)

Three-dimensional (3D) Nitrogen-doped carbon coated hierarchically porous silicon (hp-Si@NC) composite with cocontinuous skeletons and abundant interconnected macropores was prepared by a sol-gel route, followed by a magnesiothermic reduction and a polydopamine pyrolyzation. The BET specific surface area and pore volume of the obtained hp ...

Compared with traditional carbon interface, the porous carbon interface with aligned mesopores and an average pore size centered at about 3 nm ²⁴⁻²⁶ would vastly improve the ion/electron transport, which ...

We envision this versatile elastic solid electrolyte to permeate and occupy the internal voids of the porous electrode, and have the ability to encapsulate the irregularly ...

The carbon-coated porous silicon anode delivers a high capacity of 1,271 mAh g⁻¹ at 2,100 mA g⁻¹ with 90% capacity retention after 1,000 cycles and has a low electrode ...

To achieve commercial viability, work is being pursued on silicon battery anode structures and processes with a special emphasis on the cost and environment. In this review book chapter, we will summarize recent development of a cost-effective electrochemically etched porous silicon as an anode material for lithium-ion batteries.

Compared with traditional carbon interface, the porous carbon interface with aligned mesopores and an average pore size centered at about 3 nm ²⁴⁻²⁶ would vastly improve the ion/electron transport, which simultaneously buffer-the volume expansion and retain the whole structure integrity. Porous carbon with electrochemical stability is an ideal ...



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The silicon etched by HF solution possesses porous structure, which exhibits higher capacity than unetched samples. Comparatively, the silicon etched by NaOH solution has the flaky shape with about 110 nm and shows superior cycling performance and stability (600.7 mAh g⁻¹ after 200 cycles at 420 mA g⁻¹), which can be ascribed to its ...

We demonstrate multi-step synthesis of silicon porous structures with various particle sizes via low-cost annealing and pickling reactions from ball-milled Mg₂Si or Si/Mg powder. Thereinto, the ultrafine Si porous structures (< ...

Hierarchical porous silicon structures with extraordinary mechanical strength as high-performance lithium-ion battery anodes. ... to retain sufficient volumetric capacity density and high mechanical strength that can withstand calendaring and other battery assembly procedures. The porous structure evolution from CNT@SiO₂ microsphere to CNT@Si ...

In this review, the merits of using porous silicon for anodes through both theoretical and experimental study are discussed and recent progress in the preparation of porous silicon through the template-assisted approach and the non-template approach are highlighted. Silicon is of great interest for use as the anode material in lithium-ion batteries due to its high ...

Herein, we report the design and construction of novel porous silicon materials with regulated pore structure and surface oxygen content. The facile strategy for the synthesis of the materials is using Mg₂Si and tetraethyl orthosilicate (TEOS) as Si resource, and the oxygen in the feedstock is ingeniously used at the same time.

Hierarchical porous silicon structures with extraordinary mechanical strength as high-performance lithium-ion battery anodes ... Wu, H. et al. Stable cycling of double-walled silicon nanotube battery anodes through solid-electrolyte interphase control. *Nat. Nanotechnol.* 7, 309-314 (2012). Chen, D. Y. et al. Reversible lithium-ion storage in ...

The size of the silica particles plays a vital role in the structure control of the porous silicon. In this work, silica particles with a diameter of 130 nm are used as templates to guide the ...

Porous silicon-based anode materials have gained much interest because the porous structure can effectively accommodate volume changes and release mechanical stress, leading to improved cycling performance. ... Magnesiumthermic Reduction Enables HF-Free Synthesis of Porous Silicon with Enhanced Performance as Lithium-Ion Battery Anode ...

Particularly, the prelithiation of porous silicon nanowires has been extensively investigated, since the porous structure assists maintaining anode integrity through the volumetric expansions and ...



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We demonstrate multi-step synthesis of silicon porous structures with various particle sizes via low-cost annealing and pickling reactions from ball-milled Mg_2Si or Si/Mg powder. Thereinto, the ultrafine Si porous structures (< 50 nm) have been prepared by the two-step alloying/de-alloying processes between Si and Mg, and the formation processes and ...

Extensive research has been conducted on nanostructured silicon such as silicon nanoparticles 14, silicon nanotubes/nanowires 1,15, silicon thin films and 3D porous structures 16,17.

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