



Porous Silicon Nanosphere Battery

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PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	10,756,330	08/25/2020	2014-479

OTHER INFORMATION

KEYWORDS

Lithium ion battery, Silicon nanosphere, Anode, Renewable energy, Lithium Silicon battery, Electric Vehicle (EV)

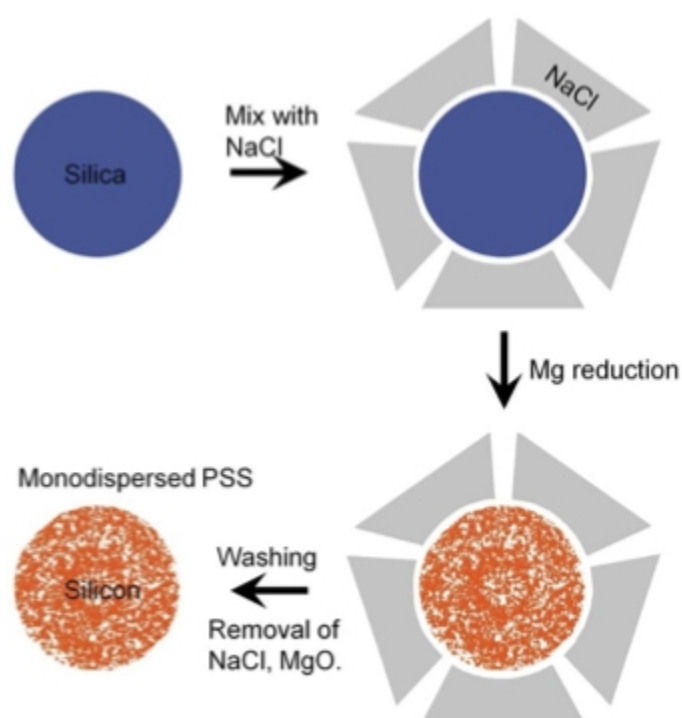
FULL DESCRIPTION

Background

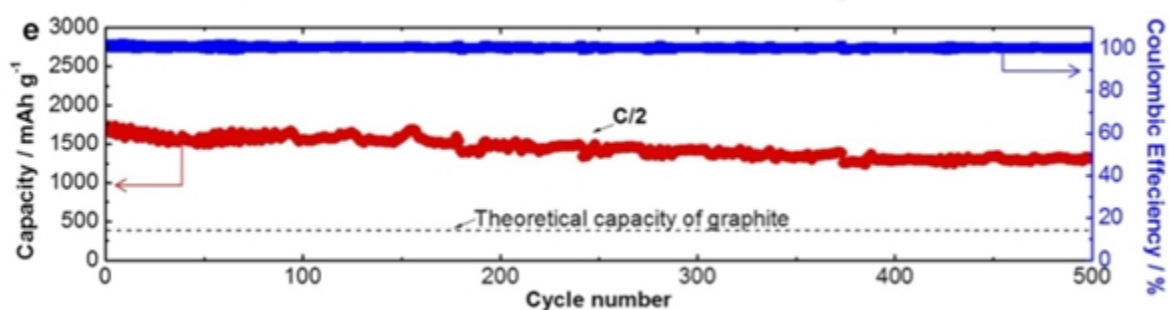
Silicon is considered to be the candidate anode material for next generation lithium-ion batteries (LIB) due to its high, theoretical capacity of 4200 mAh/gram. Large volume changes and poor capacity retention have hindered the adoption of silicon-based anodes in LIBs. Capital expenses and high processing costs of current fabrication methods are also significant obstacles in the fabrication of silicon anodes.

Current Invention

At UCR, the research team led by Prof. Cengiz Ozkan have developed a patented technology focused on the synthesis of highly monodisperse porous silicon nanospheres (MPSS) via a simple and scalable hydrolysis process with subsequent surface protected, magnesiothermic reduction.



Schematic illustration of the MPSS preparation



CATEGORIZED AS

- ▶ Energy
 - ▶ Storage/Battery
- ▶ Materials & Chemicals
 - ▶ Nanomaterials
- ▶ Nanotechnology
 - ▶ Electronics
 - ▶ Materials
- ▶ Transportation
 - ▶ Automotive

RELATED CASES

2014-479-0, 2014-173-0

Cycling performance and coulombic efficiency of MPSS electrodes at a high, C/2 current density.

ADVANTAGES

The advantages of their technology are:

- ▶ MPSS have dramatically improved electrochemical stability during lithiation and delithiation.
- ▶ Large surface, short diffusion length and the void spaces that allow for volume expansion.
- ▶ High throughput and low cost fabrication method.
- ▶ High capacity and long cycling life.

TESTING

Button type half cells, with MPSS anodes and Lithium metal cathodes, were prepared and tested. The cells achieved a very high, fully reversible capacity of ~3105 mAh/gram. After 500 charge-discharge cycles, the cells had a capacity greater than 1,500 mAh/gram and exhibited 100% coulombic efficiency under a current density of C/2.

SUGGESTED USES

- ▶ Lithium-Ion and Lithium-Silicon batteries.
- ▶ Energy storage devices.

RELATED MATERIALS

- ▶ [Monodisperse Porous Silicon Spheres as Anode Materials for Lithium Ion Batteries](#)

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