

# Porous Silicon Nanosphere Battery

Tech ID: 32650 / UC Case 2014-479-0

## PATENT STATUS

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

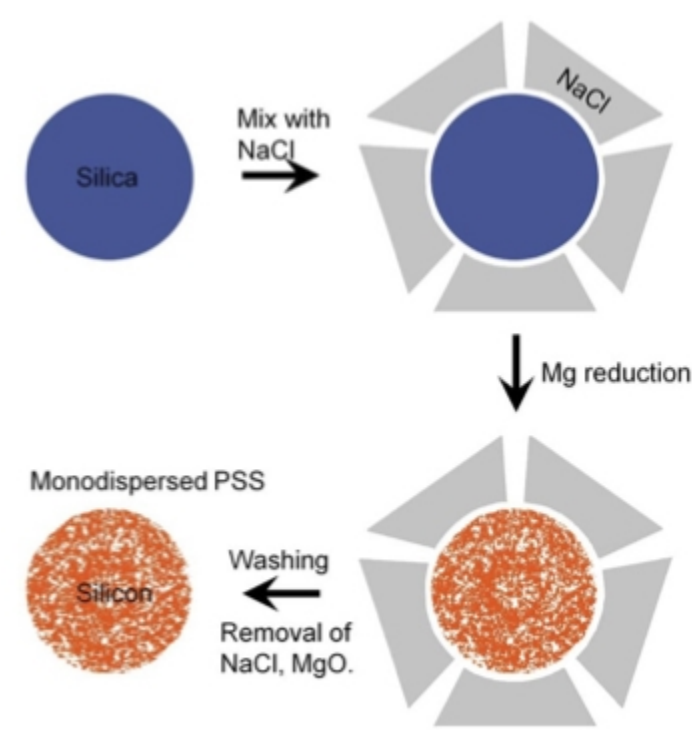
## FULL DESCRIPTION

### Background

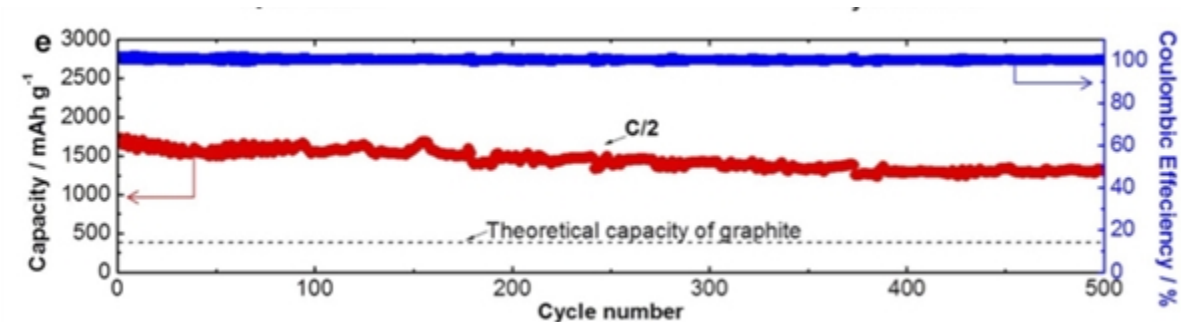
Silicon is considered to be the candidate anode material for next generation lithium-ion batteries (LIB) due to its high, theoretical capacity of 4200 mAh/gram. Large volume changes and poor capacity retention have hindered the adoption of silicon-based anodes in LIBs. Capital expenses and high processing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



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## OTHER INFORMATION

### KEYWORDS

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

### 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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