Smart Battery Architecture For Sulfur Silicon Full Cells

Tech ID: 32875 / UC Case 2017-671-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	12,057,575	08/06/2024	2017-671

FULL DESCRIPTION

Background

Sulfur is an attractive cathode material for Lithium-ion batteries (LiBs) due to its high theoretical capacity of 1675 mAh/g. Implementation has been slow due to inherent problems, such as, polysulfide shuttling, volumetric expansion and poor conductivity.

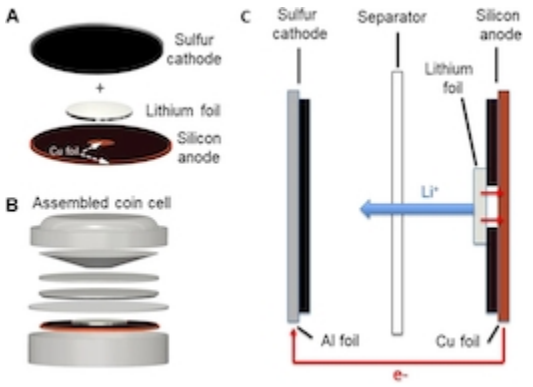
Current anode of choice for LiBs is silicon. The challenges with silicon are poor conductivity and volumetric expansion.

Researchers have identified techniques to alleviate the challenges with sulfur and silicon. This, however, has resulted in lesser focus on combining a sulfur cathode and a silicon anode - which is attractive because they are:

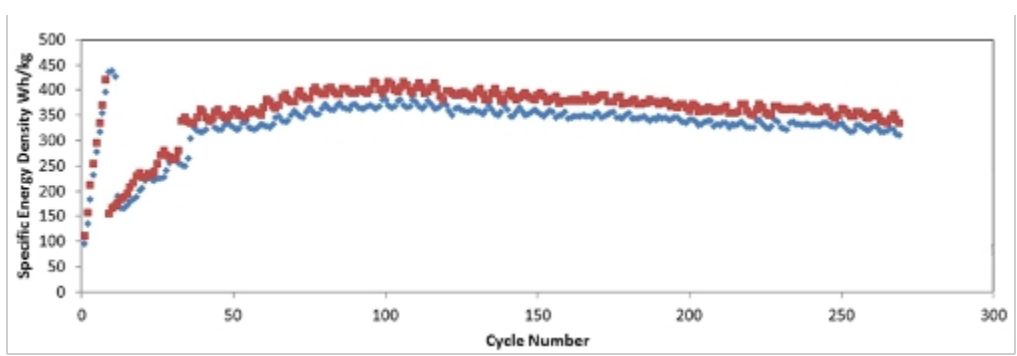
- environmentally benign;
- abundandtly available; and,
- offers a theoretical energy density of 1982 Wh/kg.

Technology

Researchers led by Prof. Cengiz Ozkan at UCR have developed a novel, patented, advanced LiB architecture with a sulfur cathode and silicon anode with lithium source integrated into the anode. The developed sulfur-silicon full cell (SSFC) exhibits an energy density of 350 Wh/kg and 95% coulombic efficiency for 260 cycles at a C/10 rate.



(A) SSFC battery architecture set up. (B) Assembled SSFC coin cell schematic. (C) SSFC cross sectional discharge schematic.



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OTHER INFORMATION

KEYWORDS

lithium-ion battery, electrochemical energy storage, silicon anode, sulfur cathode, sulfur silicon battery, energy storage

CATEGORIZED AS

- Energy
  - Storage/Battery

RELATED CASES

2017-671-0

Deep galvanostatic cycling of the SSFC at C/10 for more than 250 cycles - charge (red) and discharge (blue).

ADVANTAGES

- The architecture allows for the controlled loading of lithium to compensate for the solid electrolyte interface (SEI) formation and degradation of lithium, which helps prolong the cycle life.
- Bypasses the complications of pre-lithiated cells.
- Serves as a platform for future SSFCs.

SUGGESTED USES

- Motive and industrial energy storage applications
- Grid and stationary energy storage
- Consumer electronics, Drones, etc.

ADDITIONAL INFORMATION

- Please see recent press coverage about this innovative battery architecture.
- Please see all innovations by Prof. Ozkan and his team at UCR.

RELATED MATERIALS

- Advanced Sulfur-Silicon Full Cell Architecture for Lithium Ion Batteries

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