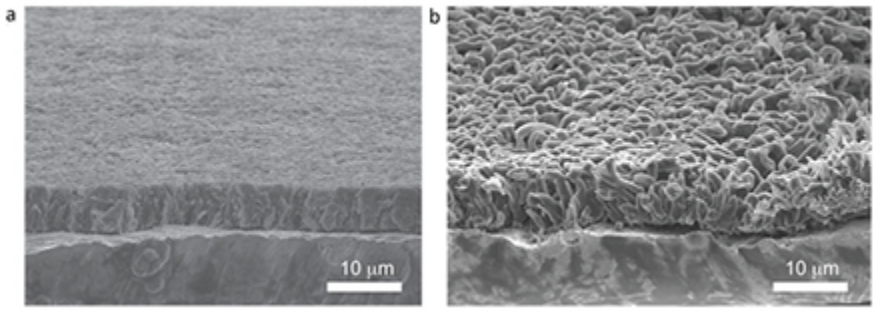
Docket #: S15-283

Stabilizing Coating for Lithium Metal Battery Anode

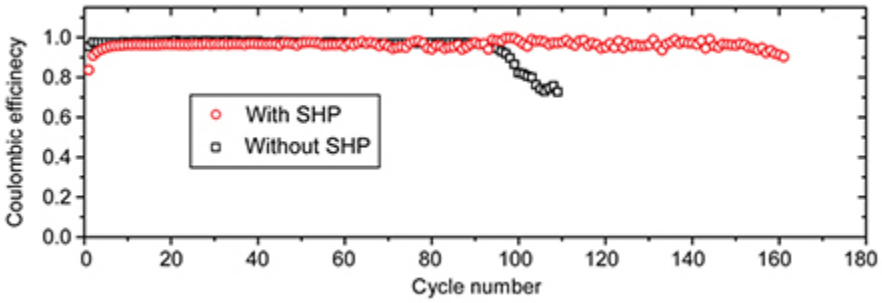
Stanford researchers developed a 'self-healing' polymer coating that conforms to and stabilizes lithium metal battery electrodes. The polymer is an extremely stretchy, flexible and adaptive protective layer. It coats the lithium anode, ensures uniform lithium ion flux, and prevents dendrite formation. Damaged regions can self-heal by reforming broken bonds. Researchers can tune the mechanical strength, viscoelasticity, healing speed and stretchiness of the polymer, making it suitable for a variety of battery electrode materials such as lithium, silicon, and tin.



SEM of deposited Lithium on Copper substrate (a) at 1 mA/cm^2 with the self-healing polymer coated electrode (b) control electrode without polymer.
Note the dramatic change in morphology on the coating –free control electrode.

Stage of Research

Researchers fabricated a lithium metal anode with the polymer coating that achieved high Coulombic efficiency of 97% for more than 180 cycles at 1 mA/cm^2 (fast charging current density levels). In contrast, the Coulombic efficiency of the bare lithium electrode dropped below 90% after 145 cycles. Uniform Li deposition was obtained at current densities as high as 5 mA/cm^2.



Cycling Coulombic efficiency of the lithium anode with and without the SHP modification

Applications

- High-Energy Density Lithium Batteries

Advantages

- **Simple Deposition Process**
- **Stable Battery Cycling** with high Coulombic efficiency

Publications

- Zheng, Guangyuan, Chao Wang, Allen Pei, Jeffrey Lopez, Feifei Shi, Zheng Chen, Austin D. Sendek, Hyun-Wook Lee, Zhenda Lu, Holger Schneider, Marina M. Safont-Sempere, Steven Chu, Zhenan Bao, and Yi Cui.High-Performance Lithium Metal Negative Electrode with a Soft and Flowable Polymer Coating. *ACS Energy Letters*. (2016):1247-255.

Patents

- Published Application: 20170062830
- Issued: 10,601,049 (USA)

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