High Energy Li Batteries with Lean Lithium Metal Anodes and Methods for Prelithiation

This technology offers a rechargeable, full lithium metal battery cell with superior stability. This system is composed of lithium metal anode with a carbon-coated copper current collector that is prelithiated (deposited).

What is the Problem?

Current lithium battery technology consists of non-rechargeable lithium metal batteries or rechargeable lithium-ion batteries; both are used to power various devices depending on whether rechargeability is desired. With ever-increasing societal energy consumption due to consumer electronics, electric vehicles, and data centers, conventional rechargeable batteries are no longer sufficient, and more efficient rechargeable battery technology is in high demand. Rechargeable lithium metal batteries, which have ten-fold the energy capacity of lithium-ion batteries for the same weight, may be able to meet society's growing energy needs. However, the materials inside lithium metal batteries are less stable than lithium-ion batteries. Lithium metal may form branch-like structures called "dendrites," damaging the battery which leads to a shorter battery life and potentially creating safety hazards for end-users.

What is the Solution?

The solution is a rechargeable, lithium metal anode cell that avoids lithium dendrite formation through a process known as prelithiation, where lithium is deposited into hard carbon on the anode side. This relieves some of the stresses associated with the first cycle lithium plating, priming the surface for stable charging and discharging. This full lithium metal battery cell that incorporates the prelithiated carbon anode can sustain roughly the same discharge capacity for at least 50 charge cycles. Through this prelithiation process, the amount of lithium used can be cut down to only what's essential, improving the energy density and saving on material cost.

What is the Competitive Advantage?

Current solutions are lithium-ion batteries, which are reaching a theoretical limit to the energy current chemistries can hold. Emerging solutions of lithium metal batteries have suffered from instability issues, limiting adoption. The performance of this solution is greater than those of similar battery cells incorporating a conventional copper anode or a pure lithium anode, while offering superior stability.

Patent Information:

Technology ID

BDP 8167

Category

Selection of Available Technologies

Cleantech/Energy Storage/Batteries

Authors

Jihui Yang

Learn more

US20230317916A1

References

1. Malay S. Patel, Matthew D. Carson, Eric J. Seibel, and Lucas R. Meza(44228) , https://www.ncbi.nlm.nih.gov/pmc/articles/PMC7899488/, IEEE J Transl Eng Health Med.