Elastic Fiber-Shaped Lithium-Ion Battery

State Key Laboratory of Molecular Engineering of Polymers, Department of Macromolecular Science and Laboratory of Advanced Materials, Fudan University, Shanghai 200438, China

Background

- Flexible, portable, wearable, and stretchable electronic devices have gained enormous popularity.
- Fiber-shaped electrochemical storage devices, featured as flexibility and weavability, emerged and thrived in response.
- Fiber-shaped lithium-ion batteries are not available because they are hindered by some down-to-earth considerations like safety.

Experimental section

1. Coating LMO
2. Coating LTO
3. Twisting
4. Cathode
5. Anode

- Tuning the amount of the Li_{4}Ti_{5}O_{12} and LiMn_{2}O_{4} in the carbon nanotube composite fibers.
- Controllable capacities.
- Flexibility and controllable stretchability.

Results and discussion

- Exhibiting an energy density of 27 Wh kg\(^{-1}\) or 17.7 mWh cm\(^{-3}\) and a power density of 880 W kg\(^{-1}\) or 0.56 W cm\(^{-3}\) with a good safety performance.
- A fiber-shaped battery with LTO and LMO composite electrodes showing an voltage platform of 1.5V.
- Capacity above 97% after 1000 cycles bending.
- Maintaining high performance at a strain of 600%.
- Capacity above 88% after stretching by 600%.

Conclusion

- Fiber-shaped full battery is made to exhibit remarkably mechanical, electrical and electrochemical properties.
- The fiber-shaped batteries are safe due to the well paired two metallic lithium-free electrodes.
- By winding the yarn cathode and anode round an elastic substrate, a spring structure was created to enable a super-stretchy performance.

Representative publication


Acknowledgement

MOST, NSFC, MOE, STCSM, GMC, Organization Department of the CPC Central Committee and the Fok Ying Tong Education Foundation.