Fabrication of Li-S Fiber Battery with Carbon Nanotube Thread-Sulfur Composite as Cathode

Goals and Objectives:

1. Study the provided literature about Li-S battery.
2. Fabrication of spinnable carbon nanotube (CNT) array by Chemical Vapor Deposition (CVD) described in the provided publications from our group.
3. Fabrication of CNT thread-sulfur (CNT-S) composites as a cathode in Li-S battery by sulfur melting method.
4. Find the content of sulfur in the CNT-S by Thermo-Gravimetric Analysis (TGA).
5. Use Scanning Electron Microscopy (SEM) to study the surface morphology of the obtained CNT thread and CNT-S.
6. Assemble Li-S fiber battery in an argon-filled glove box.
7. Test the assembled battery with a galvanostatic charge discharge instrument.
8. Measure the main characteristics and parameters related to the fabricated Li-S batteries.
9. Understand the mechanism and principle of Li-S battery.
10. Understand the critical factors affecting the performance of a Li-S battery.

Facilities:

1. **Tube furnace** to growth CNT array.
2. **Autoclave** and **air-oven** to synthesize CNT-S.
3. **Thermogravimetric analysis** (TGA) to measure the content of sulfur in CNT-S.
4. **Scanning Electron Microscopy** (SEM).
5. **Glove box** to assemble the fiber battery.
6. **Galvanostatic charge-discharge instrument** to test battery performance.

Reading materials[1,2]:

[1] Manthiram, A., Chung, S. H., & Zu, C. (2015). Lithium–sulfur batteries: progress and prospects. Advanced materials, 27(12), 1980-2006.

[2] Zhang, Y., Zhao, Y., Ren, J., Weng, W., & Peng, H. (2016). Advances in Wearable Fiber‐Shaped Lithium‐Ion Batteries. Advanced Materials, 28(22), 4524-4531.

Other information:

1. Alvarez, N. T., Miller, P., Haase, M., Kienzle, N., Zhang, L., Schulz, M. J., & Shanov, V. (2015). Carbon nanotube assembly at near-industrial natural-fiber spinning rates. Carbon, 86, 350-357.