

Fabrication of The Novel Free-standing Three-dimensional Graphene Sulfur Composite as a cathode for Li-S battery

Goals and Objectives:

1. Study the provided literature about Li-S battery.
2. Fabrication of three-dimensional graphene (3DG) by Chemical Vapor Deposition (CVD) described in the publications from our group.
3. Fabrication of 3D graphene-sulfur (3DG-S) composites as a cathode in Li-S battery by solvothermal reaction.
4. Find the content of sulfur in the 3DG-S by Thermo-Gravimetric Analysis (TGA).
5. Use Scanning Electron Microscopy (SEM) to study the surface morphology of the obtained 3DG-S and 3DG.
6. Assemble coin-type Li-S battery in an oxygen-free 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 3DG.
2. **Autoclave** and **air-oven** to synthesize 3DG-S.
3. **Thermogravimetric analysis** (TGA) to measure the content of sulfur in 3DG-S.
4. **Scanning Electron Microscopy** (SEM).
5. **Glove box** to assemble the coin-type battery.
6. **Galvanostatic charge-discharge instrument** to test battery performance.

Reading materials^[1,2]:

- [1] A. Manthiram, Y. Fu, S. Chung, C. Zu, Y. Su. Rechargeable Lithium–Sulfur Batteries. *Chem. Rev.* **2014**, *114*, 11751.
- [2] A. Manthiram, S.-H. Chung, C. Zu. Lithium–Sulfur Batteries: Progress and Prospects. *Adv. Mater.* **2015**, *27*, 1980.