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Electrode Engineering for Lithium Sulfur Solid States Batteries

Keywords: Electrochemistry, Li-S batteries, Elaboration

Offer description:

Lithium-sulfur batteries are one of the most promising post Li-ion batteries. Indeed, these systems have a high theoretical capacity and sulfur is abundant in the nature. However, with liquid electrolyte, these batteries don't meet the expected capacity because of the polysulfide shuttle effect. Furthermore, the use of organic solvents as electrolyte causes the formation and growth of lithium metal dendrites and also arises safety issues because of their flammability. All solid-state battery using Single-Ion Polymer Electrolytes (SIPE) offer several advantages: hindering the polysulfide shuttle effect and dendrite formations, and elimination of the risks associated with toxic and flammable liquid electrolytes. However, when using new electrolytes, in particular polymer, the electrode engineering as well as the contact between the electrode and the electrolyte have to be adapted to enable both ionic and electronic transport, and avoid any remaining porosity.

In this context, we are offering a master thesis on the electrode engineering for polymer-based batteries. The intern will focus on the elaboration of electrodes by changing the ratio of sulfur/ionic conductor (polymer electrolyte)/conductive agent (nano carbon) to improve both electronic and ionic transport. The electrode will be characterized by electrochemical techniques (long term cycling, impedance measurement, etc.). Furthermore, the electrodes will be fully characterized before cycling by means of AC/DC polarization measurement, to assess ionic/electronic transport, as well as by SEM (scanning electron microscope) and X-ray tomography techniques to see the morphology and microstructure of the electrode, to correlate electrochemical performance to the electrode engineering and microstructure. Investigation of Li metal counter electrode will be also carried out especially by XPS and SEM.

The internship will be based at the LEPMI laboratory in Grenoble.

Goals

- Electrode engineering
- Characterization of the electrochemical performance of all-solid-state cells
- Material characterization and data processing
- Writing elaboration protocols and experimental reports

Student profile: We are looking for a Master student with a background in material and/or chemistry. Electrochemical interest/experience is an asset.

Duration: 3-6 months

Location: LEPMI (laboratory on Grenoble Campus, France)

Starting date: February 2026

To apply to this master thesis please send your CV and motivation letter to Marie Guenault (marie.guenault@grenoble-inp.fr)