LEPMI – Antenne Phelma Campus
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Modelling and investigating lithium plating during fast charging of graphite electrode

Keywords: Li-ion battery, modelling, lithium plating, COMSOL

Offer description:

Fast charging is a major challenge for lithium-ion batteries. as a competition could occur between lithium intercalation in graphite and deposit of Li metal at the surface of graphite electrode. This process, known as lithium plating, can reduce reversible capacity and compromise battery safety. Understanding when and where lithium deposition starts requires accounting for electrochemical kinetics, electrolyte transport, and the local lithiation dynamics of graphite.

We are offering a six-month Master's internship focused on modelling (using COMSOL software) the interaction between lithium nucleation, deposition, and graphite phase separation. The student will work with existing models developed at the laboratory and extend them to implement lithium plating and stripping. The objective will then be to investigate how the nucleation barrier and heterogeneous graphite lithiation influence the onset, spatial distribution, and amount of metallic lithium deposited during fast charging.

First, the student will conduct a targeted literature review to identify the physical mechanisms and modelling approaches required to implement lithium plating and stripping in the existing P2D model. The model will then be extended to account for lithium nucleation and deposition and to investigate their interaction with graphite lithiation and phase separation. In a second step, the physics-based approach developed in the P2D model will be extended to a three-dimensional microstructure-resolved model. This approach will provide a detailed description of lithium plating and make it possible to investigate the influence of electrode microstructure on the localisation and evolution of lithium deposition. Model predictions will be compared with available experimental and/or published data.

Location: LEPMI, Grenoble university campus, 1130 Rue de la Piscine, 38402 Saint Martin d'Hères, France

Student profile:

- Master student in Materials Science, Electrochemistry, mathematics, or a related field.
- Knowledge in Modelling is an asset
- Good experimental skills, ability to work collaboratively, curious and eager to learn, open.

This position offers an exciting opportunity to contribute to understanding of lithium-ion battery limitation under fast charging condition in a dynamic research environment. If you are passionate about advancing energy storage technologies, modelling and enjoy working on complex challenges, we encourage you to apply by sending your resume and cover letter to Pierre HUGON (pierre.hugon@grenoble-inp.fr).

Duration: 6 months

Starting date: February-March 2027