Laboratoire d'Electrochimie et de Physico-chimie des Matériaux et des Interfaces (UMR 5279)

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**Understanding graphite lithiation in Li-ion batteries using ultrasound techniques**

**Keywords:** Li-ion battery, electrochemistry, ultrasounds, material science

**Offer description**

Li-ion batteries are currently dominating the market of energy storage and graphite is massively used as negative electrode. Graphite was studied a lot since the 50's regarding its properties of lithium intercalation, however we still lack some understanding to improve the battery performance. One major issue concerns the power properties of graphite electrodes limiting the charging time.

A second important aspect for Li-ion technology relies on the diagnostic of their state of charge (SoC) and state of health (SoH). One solution envisaged is to use ultrasound waves as probing tool to estimate the state of charge, with the advantage of ultrasounds being low-cost, non-destructive and easy to handle.

Correlating the two pre-cited parts, i.e. understanding of graphite (de)lithiation using ultrasound waves can help designing better electrode by probing their mechanical weaknesses. This master thesis will first focus on the electrochemical performance of homemade electrodes with different graphite grades. Then, the second important part will be to answer the following questions: what are ultrasounds sensitive to in our system? And what information can we get back about graphite? A correlation with dilatometric measurement is not excluded to understand mechanical stress/strain in the electrodes.

This master thesis is an opportunity to discover fundamental research on an applied subject (Li-ion batteries), combining bibliographic research, experimental studies and development of new methods/tools. During this master thesis, the student will develop skills in the field of applied electrochemistry, energy storage devices and autonomy in a research approach.

**Location:** LEPMI laboratory on Grenoble university campus, FRANCE

**Goals**

- Preparation of home-made electrodes and half cells assembly (in glovebox)
- Electrochemical characterization and cells cycling
- Recording ultrasounds signal under cell operation (*in operando* characterization)
- Data treatment and interpretation

**Student profile:** background in chemistry and/or material science, plus value for a student familiar with electrochemistry or energy storage thematic.

**Duration**: 5 – 6 months **Starting date**: Janvier – Avril 2025

To apply to this master thesis please send your CV and motivation letter to Corentin RENAIS (corentin.renais@grenoble-inp.fr).