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Electrolyte formulation for "anode-less" lithium metal batteries

Keywords: anode-less, lithium plating, liquid electrolyte, electrochemical performance, post mortem characterizations

Offer description:

Anode-less lithium metal batteries are an interesting alternative to Li-ion batteries, providing high energy density and simplifying the manufacturing process. Indeed, the cell is assembled without Li metal as a negative electrode; instead, the electrode is generated "in situ" during the deintercalation of Li ions from the positive electrode, which are then electroplated onto the negative electrode current collector[1].

Unfortunately, depositing a uniform layer of lithium metal is a challenge. Indeed, Li is not easily deposited homogeneously, and it can also react with the electrolyte and be passivated, leading to the formation of mossy and dead Li, which reduces the amount of active Li. This phenomenon limits the achievable specific capacity and explains the low coulombic efficiency (CE) hindering the development of this technology. Since the stability of the deposit and its uniformity are linked to the electrolyte, we propose to study the electrolyte's influence on the first lithium nucleation on the current collector and on the global cell performance.

In this context, we offer a master's thesis in our laboratory to investigate the electrolyte formulation and its impact on anode-less technology. The internship will focus on the characterization of batteries using different electrolytes by varying the salt and solvent. The student will formulate the electrolyte, assemble the cells, and assess their electrochemical performance using advanced electrochemical methods such as constant current/constant voltage (GCPL) and impedance spectroscopy. Electrochemical results will be correlated to additional post-mortem investigations such as scanning electron microscopy (SEM) to observe the homogeneity and the morphology of the deposit and X-ray photoemission spectroscopy (XPS) to analyze its chemical composition.

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

Student profile:

- Master's student in Materials Science, Electrochemistry, Chemistry, or a related field.
- Knowledge of electrochemical characterization (galvanostatic cycling, EIS) or material morphology characterization is an asset
- Good experimental skills, ability to work collaboratively, curious and eager to learn, open-minded.

This position offers an exciting opportunity to contribute to next-generation battery technology in a dynamic research environment. If you are passionate about advancing energy storage technologies and enjoy working on complex challenges, we encourage you to apply by sending your resume, grade and cover letter to Emma MOUREY (emma.mourey@grenoble-inp.fr).

Duration: 5 – 6 months

Starting date: February-March 2027