

2022

Thesis Subject : Proposal

Titre	Direct recycling of Li-ion battery materials: impact of cathode chemistries on the selective sorting of used Li-ion batteries.
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Scientific project key words : Recycling, Li-ion Batteries, Materials, Energy

With the development of electric transport using Li-ion technology in its batteries, the recycling and reuse of end-of-life battery components is a responsible approach to generating new sources of raw materials.

This thesis project is part of the concept of direct recycling of NMC type cathode materials of general formula $\text{LiNi}_x\text{Co}_y\text{Mn}_z\text{O}_2$ (positive electrodes). It aims to understand the impact of a mixture of cathodes of different chemistries on the recycling processes, the nature and the properties of the recycled materials. Regenerating a material in a direct way, consists in giving back to the degraded material the quantity of missing elements (lithium ions, transition elements). While the approach is easily understood from a single material, what if the system to be treated is a mixture of materials of the same family? This work will have to answer the question "is it possible to form an electrode material of average composition and electrochemically active by chemical treatment of a mixture of degraded materials?"

This thesis will be financed by public funding.

Beginning : october 2022

Techniques de caractérisation

Electrochemical characterization, X-ray and neutron Diffraction, electronic microscopy (TEM and MEB), thermal analysis, specific area, Infrared, UV-Vis spectroscopy, ICP, ...

Références

- [1] Effective and environmentally friendly recycling process designed for LiCoO_2 cathode powders of spent Li-ion batteries using mixture of mild organic acids", G.P. Nayaka *et al.*, Waste Management, 78 (2018) 51.
- [2] "Green and facile method for the recovery of spent Lithium Nickel Manganese Cobalt Oxide (NMC) based Lithium ion batteries", D.Pant *et al.*, Waste Management 60 (2017) 689.
- [3] "Effect of impurities caused by a recycling process on the electrochemical performance of $\text{Li}[\text{Ni}_{0.33}\text{Co}_{0.33}\text{Mn}_{0.33}]\text{O}_2$ ", S. Krüger *et al.*, Journal of Electroanalytical Chemistry 726 (2014) 91.

Candidate profile / Skills

Master 2 or equivalent in materials chemistry

Fundamental knowledge: synthesis and characterization of materials with basic analytical techniques. A plus: knowledges in electrochemistry

The candidate must be motivated, curious, and willing to invest in an important subject.

Application Form

CV, Cover letter, Transcripts, Master's degree or equivalent, Letters of recommendation.