

# SUSTAINABLE MATERIALS, PROCESSES AND SYSTEMS FOR ENERGY TRANSITION

## DM 352 - Development of industrial processes of novel lithium batteries in a circular economy

<b>Funded By</b>	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [Piva/CF:97429780584] ALMA MATER STUDIORUM UNIVERSITA' DI BOLOGNA [Piva/CF:01131710376]
<b>Supervisor</b>	LAMBERTI ANDREA - andrea.lamberti@polito.it
<b>Contact</b>	Matteo Cavalletti, matteo.cavalletti@midacbatteries.com Francesca Soavi, francesca.soavi@unibo.it
<b>Context of the research activity</b>	<p>The proposed research project aims to develop industrial processes to produce innovative lithium-ion batteries, with low environmental impact and cost from secondary raw materials obtained from MIDAC recycle/recovery process starting from spent cells.</p>
	<p>Scholarship funded under the MD 352/2022 by MIDAC SpA /MUR/ University of Bologna - CUP: E12B22000920005 Main seat to carry out the research: MIDAC SpA, Soave (Verona) and Department of Chemistry "Giacomo Ciamician", University of Bologna (Bologna) Supervisor: Matteo Cavalletti (matteo.cavalletti@midacbatteries.com) and Francesca Soavi (francesca.soavi@unibo.it)</p> <p>In collaboration with MIDAC, in the context of IPCEI project, will be fine-tuned processes to produce electrodes starting from recycled materials of spent cells, using sustainable binder such as water-soluble polymers. The recovered materials will be analyzed considering purity and composition and will be utilized for the synthesis of active electrode materials (transition metal oxides). These materials will be developed taking in consideration the high-grade material purity, its structure and its morphology and it will be used for the preparation processes of composite electrodes. The resulting electrodes will be studied by means of electrochemical techniques in half-cell. The outcomes will be strategic for the definition of industrial process and will be validated in full cells in lab scale and, subsequently forecasting them to be applied in larger cells, employing commercial and/or innovative separators and electrolytes.</p>

<b>Objectives</b>	<p>Developed cells will be designed especially for the motive power industrial field (such as forklift, transpallet, etc.) aligned with electric transformation strategies within productive industry.</p> <p>This project aims to train a new professional profile for interdisciplinary fields which include energetic sustainability, circular economy and process engineering.</p> <p>Planned activities:</p> <p>The following activities are planned:</p> <ol style="list-style-type: none"> <li>1) Analysis and evaluation of synthesis precursors for electrode active materials, derives from recycling process of MIDAC (physical chemical characterization e.g., XRD, SEM, TEM, TGA, Raman, FTIR-ATR).</li> <li>2) Synthesis of electrode active materials (i.e., idrothermal synthesis, solid state calcination) and their physical chemical (XRD, SEM, TEM TGA, Raman, FTIR-ATR) and electrochemical characterization (cyclic voltammetry, galvanostatic techniques, impedance spectroscopy, in half cell) by preparation of electrodes using conventional binder (fluoride polymers).</li> <li>3) Formulation and preparation of composite electrodes with water-processable binder (cellulose, alginate, pullulan), and electrochemical characterization in half cell.</li> <li>4) Validation in full cells assembled with new synthesized materials (laboratory scale) by electrochemical tests.</li> <li>5) Definition of industrial productive process</li> </ol>
<b>Skills and competencies for the development of the activity</b>	<p>He/she should have experience in electrochemical field and familiarity with lab facilities. Experience in electrode formulation and cell assembly would be highly beneficial. Passionate and curiosity-driven personality with strong enthusiasm for application-oriented research are essential in the candidate. Ability to work in a collaborative environment, efficiently communicate results, ability to write technical report and scientific papers are preferred. Good English knowledge is mandatory</p>