

Electrochemical study and scale up of metal anode hybrid battery supercapacitor devices

This research aims at developing sustainable **Hybrid Battery Supercapacitors (HBSCs)** technologies, with a focus on metals anodes as in the case of zinc-based systems and complementary work on lithium-based systems. It will be carried out within a **Marie Skłodowska-Curie Action (HORIZON MSCA) Doctoral Network**, part of a wider European initiative granted by the **European Research Executive Agency (REA)** and dedicated to next-generation energy storage technologies. The project, officially named **INCEPTION (Inspiring New doctorate Candidates to Empower the Production of interconverTible and Optimized ziNc-based batteries and supercapacitors)**, follows a **Safe-and-Sustainable-by-Design (SSbD)** framework to guide material selection, device engineering, and methodological choices, in collaboration with **Novac**, an Italian company developing and manufacturing innovative supercapacitors. The core activities focus on optimising zinc anodes together with advanced current collectors, and on studying the metal plating and stripping electrochemical processes. A specific part of the work will be dedicated to the development of suitable electrolytes able to keep good reversibility, power performance and long cycling life, while reducing the typical issues of metal anodes related to dendrite formation and instability during cycling. Electrochemical evaluation through galvanostatic cycling, impedance spectroscopy, and potentiostatic techniques will provide a deeper understanding of the behaviour of metal anodes HBSCs. Furthermore, the results will support the scale-up of cell prototypes, moving from laboratory coin cells to pouch-cell configurations, with expected capacitances above 500 F.