ASTRABAT

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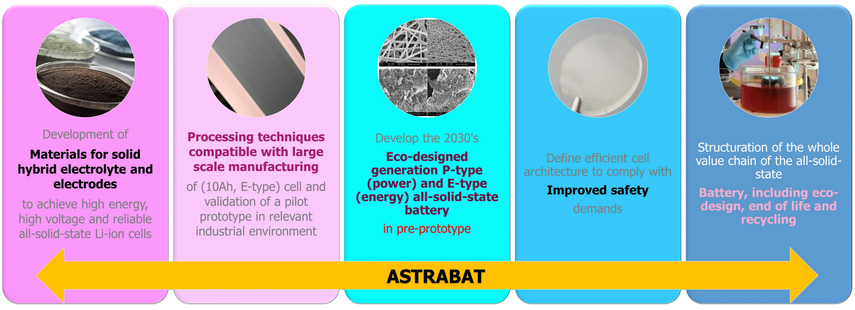
NEW EFFICIENT LITHIUM BATTERIES FOR ELECTRIC VEHICLES

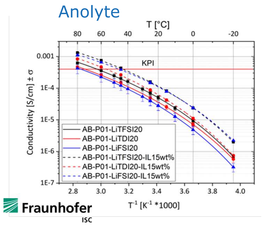
The EU project **ASTRABAT** (2020-2023) developed a **new all-solid-state lithium-ion battery** for the electric vehicle market. The goal was to fulfil the need for a safe, high-energy, sustainable and marketable **battery for electric mobility** that could be manufactured in Europe on a massive scale and **help the EU reduce its green-house gas emissions**.



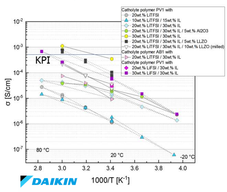
A double polymer electrolyte tailored to anode (Si) and cathode (NMC)

KPI: ionic conductivity : 0.4 mS cm^{-1}
Electrochemical stability window: 0 V - 4.5 V

Anolyte

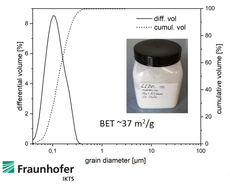


Catholyte



$Li_7La_3Zr_2O_{12}$ (LLZO) as highly ion-conductive ceramic additive for hybrid solid separator

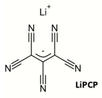
High quality LLZO powder
Ionic conductivity : 0.3 mS cm^{-1}
Particle size D_{90} : 210 nm



Free-standing catholyte membrane

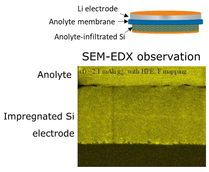
New lithium salts and ionic liquid plasticizers

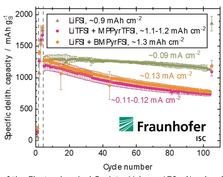
Ionic conductivity in liquid electrolyte (20°C) : 10 mS cm^{-1}
More stable thermally
More stable in the presence of water



Electrolyte impregnation

Anolyte well-impregnated into the aqueous-processed Si



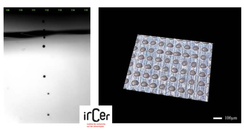


Göttlinger et al. (2023) Journal of the Electrochemical Society, Volume 170, Number 3

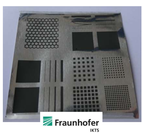
Exploring 3D manufacturing of solid-state batteries

Goal: increase the power density by reducing electrolyte path-way resistance → 3D architecture with additive manufacturing

Cathode pillars fabricated by ink-jet printing

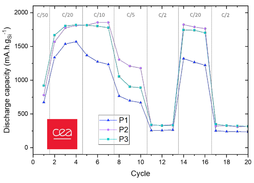


Multiple cathode designs by screen-printing



Full cell upscaling

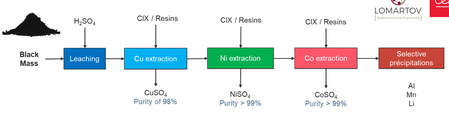
Electrolytes deposited by tape-casting onto the electrodes



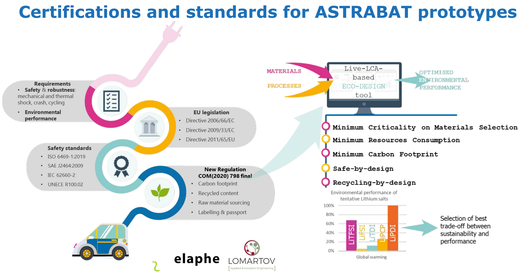
Cycling at 60°C
3.0 - 4.1V

Recycling ASTRABAT cell via two approaches

1. **Pyrometallurgy**: conventional and efficient for lower-value products or raw materials.
2. **Hydrometallurgy**: high-qualitative precursors for the synthesis of fresh active materials.



Certifications and standards for ASTRABAT prototypes



https://astrabat.eu/

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