

GRAdient- and multi-matERial procEssing of Next-generation solid-state-lithium-BAtteries using direct maTERial processing.

Research partners and **their role**

- ❑ University of Turku, Finland (Coordinator)

Development of laser direct energy deposition and assessment of cell constituents and cells

- ❑ University West, Trollhättan, Sweden

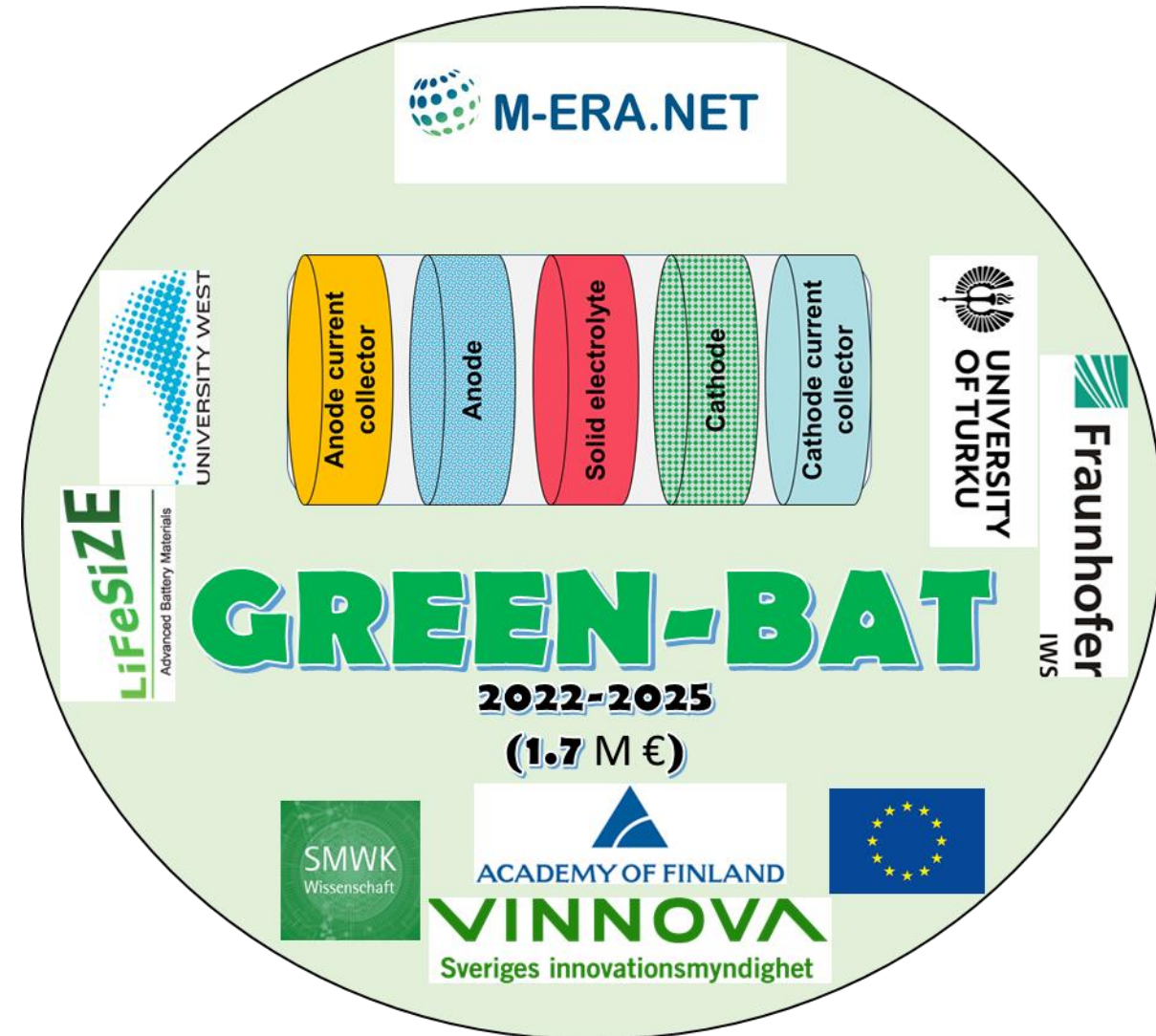
Development of plasma spray and assessment of cell constituents

- ❑ LiFeSiZE AB, Uppsala, Sweden

Processing of state-of-the-art cell for benchmarking and assessment of cell constituents and cells

- ❑ Fraunhofer IWS, Dresden, Germany

Development of laser direct energy deposition and assessment of cell constituents



State-of-the-art challenges and GREEN-BAT solution

State-of-the-art

- ❑ Most of the state-of-the-art solid state battery manufacturing technologies share some common issues such as high cost, high scrap-rate, low throughput in terms of GWh/year production and most importantly scalability and mass-production.
- ❑ In fact as per the state-of-the-art approach all cell constituents are manufactured independently, which brings in additional production steps for assembly such as pressing, sintering, welding, etc.

GREEN-BAT solution

- ❑ GREEN-BAT is proposing a novel way to produce solid-state-battery constituents (current collectors, electrodes and electrolyte) and explore sequential processing for their facile consolidation into full cells using direct material processing additive manufacturing and coatings technologies, namely laser direct energy deposition and plasma spray. Both of these technologies are well established for several applications but batteries and therefore they can be easily industrialized after successful development for battery applications.

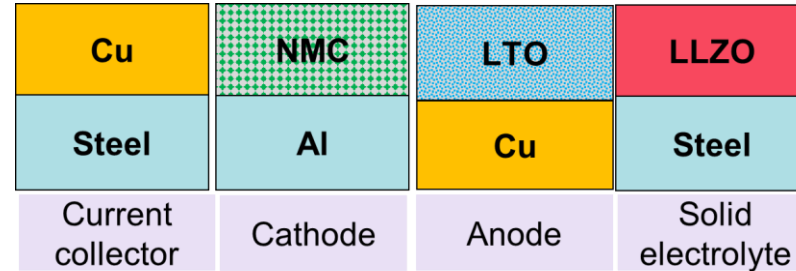
GREEN-BAT approach

Development of full cells in 3 processing steps supported by in-depth microstructural, electrochemical and mechanical evaluation

Single layer architecture

Step:1

Processing of individual battery constituents



Bi-layer architecture

Step 2:

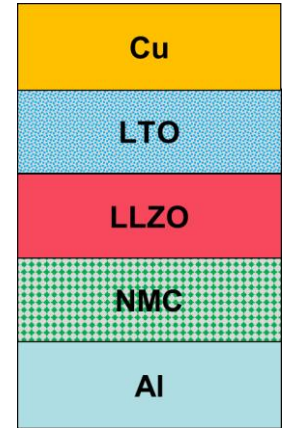
Processing of half cells



Multi-layer architecture

Step 3:

Processing of full cells



GREEN-BAT outcomes

The expected technical outcomes of the GREEN-BAT project would be:

A) Immediately after the end of the project:

- Basic know-how generated on how to process individual solid-state-battery constituents using plasma spray and laser direct energy deposition processes as well as how to produce half and full cells

B) Within two-five years from the completion date:

- Adoption of direct material processing approach to perform the single-step manufacturing of solid-state-batteries on a large scale, especially using plasma-spray and laser direct energy deposition by potential end users or service-providers.