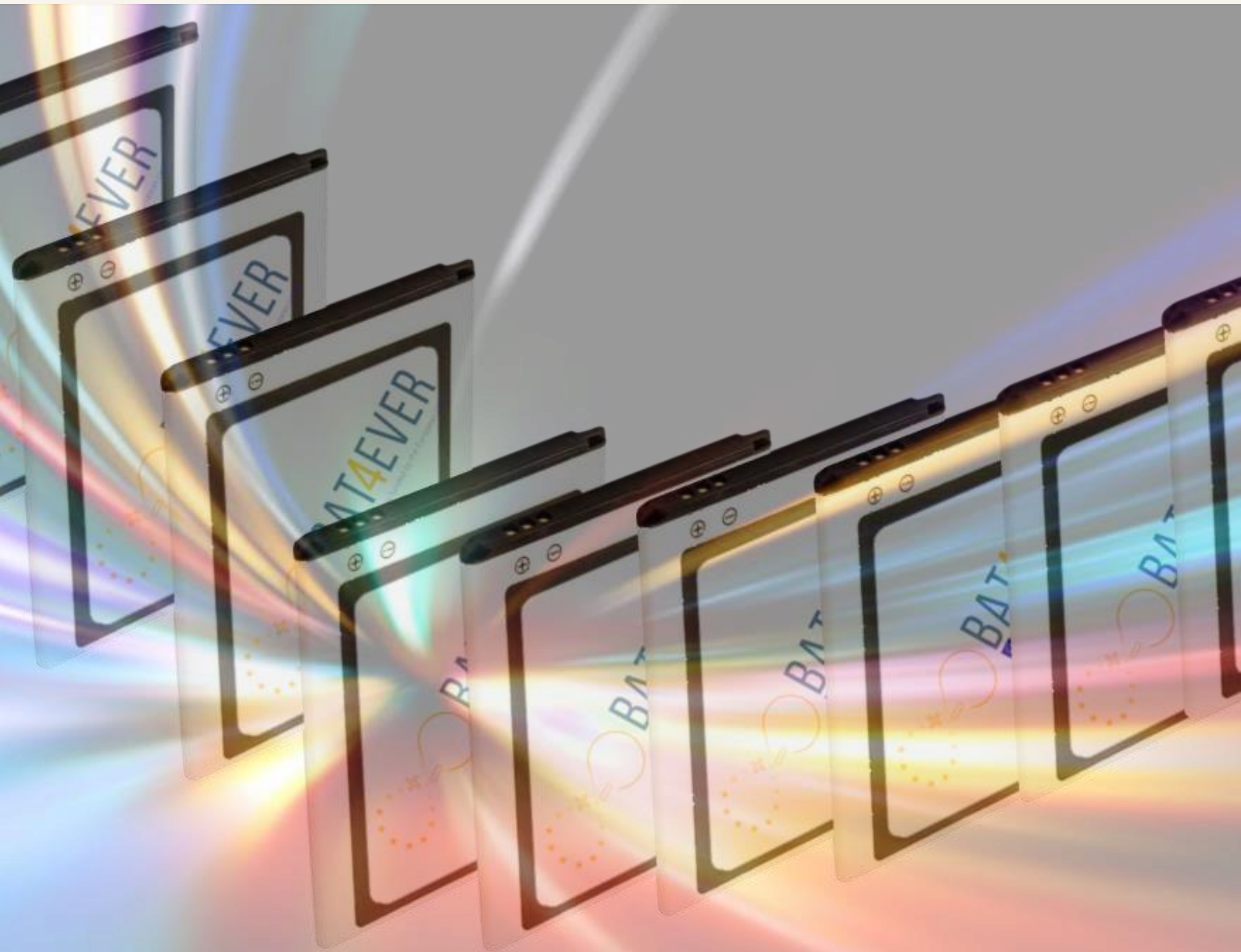


PROJECT NEWSLETTER

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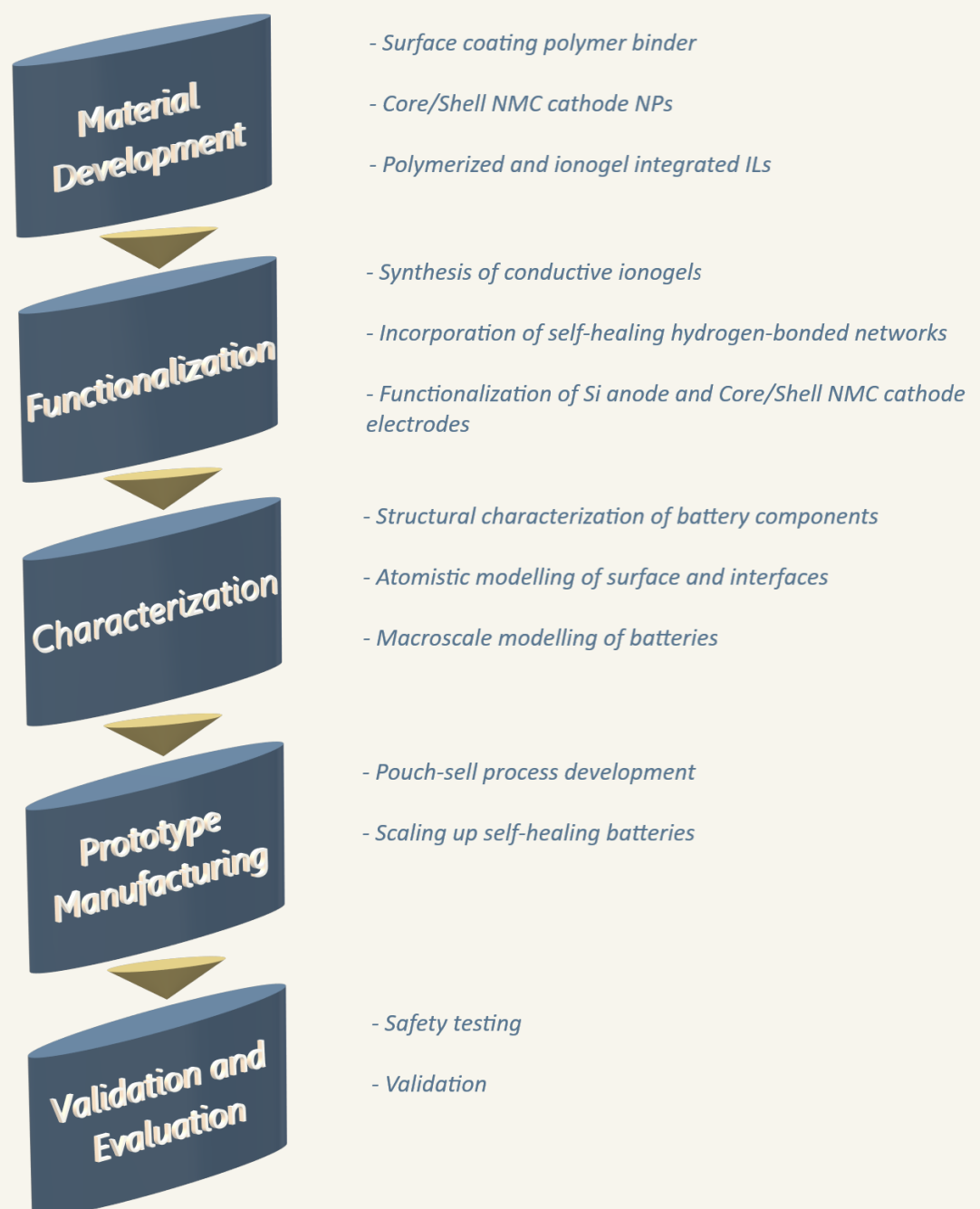
Battery 2030+ large-scale research initiative

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Autonomous Self-Healing polymer based Components for high performance Lithium Ion Batteries

BAT4EVER is one of the six research projects that is funded in the frame of BATTERY 2030+ initiative. The BAT4EVER project aims to tailor the materials of LIBs by modifying their well-established state-of-art ancestors and inducing self-healing functionalities (mechanical, structural and chemical) and thus to achieve innovative, higher performant, capable of extended lifetime, safe and reliable Li-ion batteries.



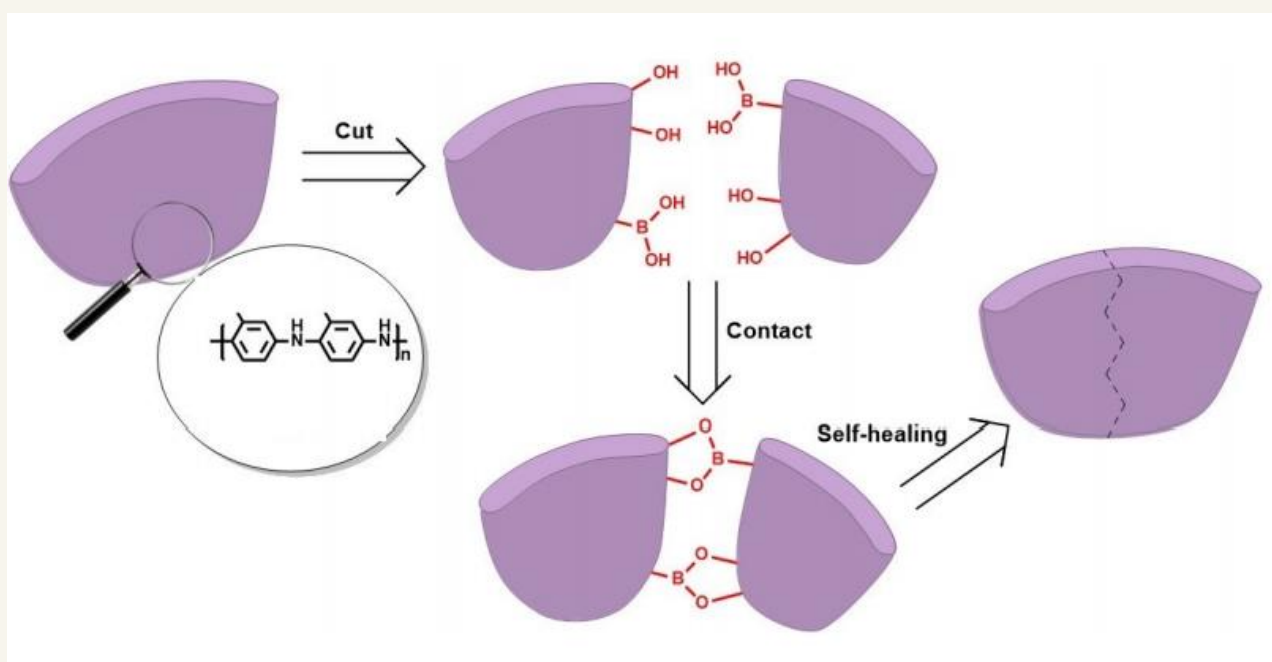
THE MISSION OF THE PROJECT

Objective 1. Development of innovative nanostructured and self-healing polymer supported battery materials

- ✓ Synthesis of self-healing anodes through polymer binder surface coating
- ✓ Synthesis of self-healing oxidation and thermal stable Mn-rich shell and Ni-rich core nano-patterned cathodes embedded in self-healing binders
- ✓ Synthesis of novel polymerized electrolytes

Objective 2. Development of innovative ionogels embedded, self-healing tailored all battery components

- ✓ Synthesis of ionogels to maintain ion-conductivity and sufficient mechanical flexibility
- ✓ Surface functionalization of anode and cathode particles
- ✓ Incorporation of the metal organic framework onto the polymer bone
- ✓ Synthesis of highly electrochemically stable ionic polymer membranes for the development of tailored made gel polymer electrolytes





THE MISSION OF THE PROJECT

Objective 3. Advanced Characterization, Modelling and Simulation Techniques to define the battery component properties under the introduced self-healing influences

- ✓ Advanced materials characterization with ex-situ correlative microscopy, in-situ and in-operando approaches
- ✓ Ab-initio determination of thermodynamic stability of electrodes
- ✓ Ab-initio study of electrode/electrolyte interface interaction in self-healing induced systems
- ✓ Self-healing effect on the NEB-kMC Li diffusion at the electrode/electrolyte interface
- ✓ Modelling and simulation assisted optimization of material properties, interface interactions within the electrodes and between the battery components
Macroscale Multiphysics Model development for SH-LIBs

Objective 4. Development of innovative, self-healing and cost-effective, battery cell/prototype assembly and manufacturing techniques

- ✓ Manufacturing of prototypes and integration of the self-healing battery components into desired cell designs
- ✓ Manufacturing verification of new material compositions for both types of cell designs to achieve cost effective, safer and high performant LIBs
- ✓ Fabrication of batteries and process parameter optimization

Objective 5. Validation and tailoring of LIB properties to yield high performant self-healing cells for the envisaged application field – smart mobile systems

- ✓ Test and demonstration of developed prototypes in an application environment
- ✓ Evaluation of recyclability
- ✓ Validation of self-healing battery prototypes under real-term use in smart cell phones

BAT4EVER PROJECT TEAM

The BAT4EVER consortium is a strong partnership between

➤ **4 LEADING UNIVERSITIES**



➤ **2 RESEARCH CENTERS**



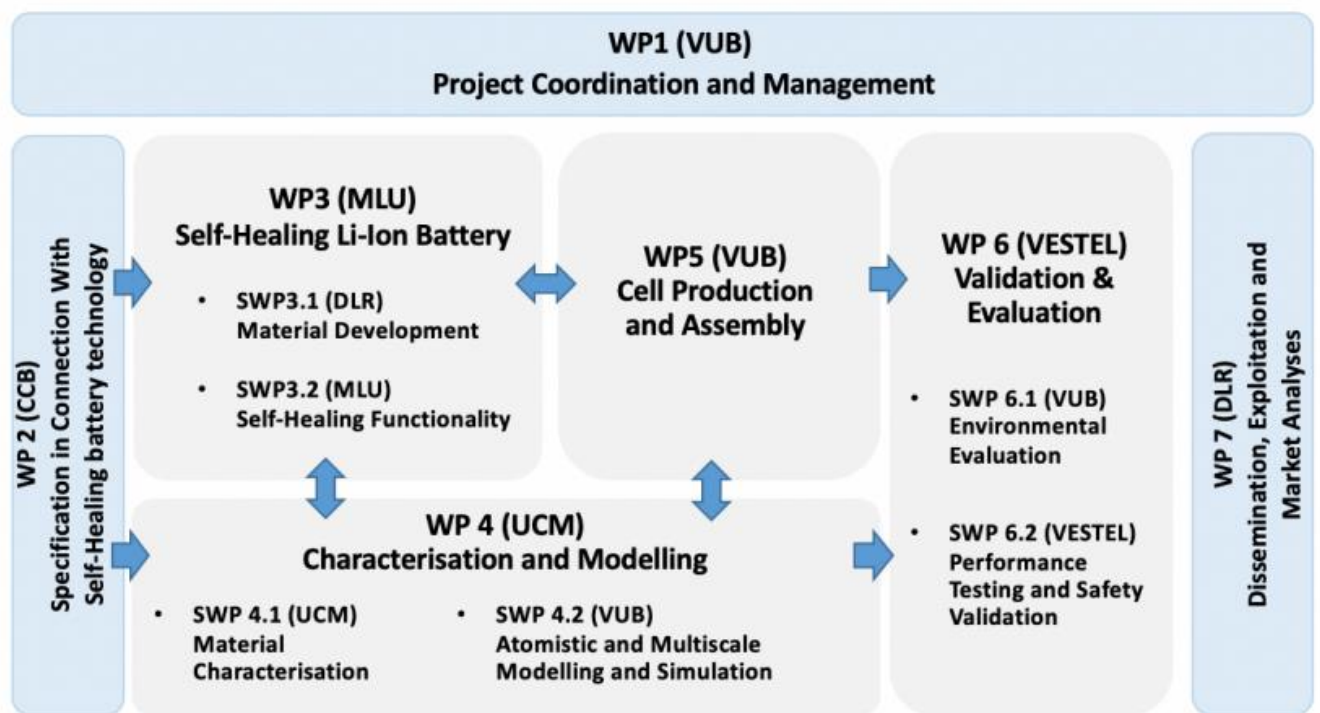
➤ **4 INDUSTRY PARTNERS**



5 European countries (*Belgium, Germany, Spain, Italy and Luxembourg*) are present in this consortium, together with *Turkey*, associate member of Europe.

The consortium contains partners with special expertise on a wide spectrum of battery field, from material synthesis and testing, to cell production and final application, what will enable the partners to close the gaps in the existing knowledge of self-healing properties and applications of materials.

ROLE OF PARTNERS IN THE PROJECT



VUB-MOBI – Coordination and Prototype Manufacturing

- ✓ Project management (WP1)
- ✓ Leading the cell processing and prototype production (WP5)
- ✓ Contribution to the definition of battery specification (WP2)
- ✓ Environmental evaluation of prototypes (WP6)
- ✓ Modelling of the self-healing battery system (WP4)

ENWAIR – SME – Battery producer

- ✓ Production of self-healing anode (WP3)
- ✓ Contribution to the definition of battery specification (WP2)
- ✓ Processing and Fabrication of self-healing batteries (WP5)
- ✓ Validation of prototypes (WP6)

MLU – Self-healing polymer development

- ✓ Leading the developing and preparing of the next generation self-healing Li-ion batteries (WP3)



ROLE OF PARTNERS IN THE PROJECT

DLR –Development of Core/Shell Cathode Material. Dissemination and Exploitation

- ✓ Contribution to the definition of battery specification (WP2)
- ✓ Development of self-healing battery components (WP3)
- ✓ Material characterization and electrochemical testing (WP4)
- ✓ Leading the dissemination and exploitation activities of the project (WP7)

IoLiTec – SME – Electrolyte development

- ✓ Development and scaling up of the ionic liquid-based electrolytes (WP3)

UCM – Advanced Characterization

- ✓ Material characterization of the cathodes and anodes(WP4)

UNIMORE – Modelling

- ✓ Atomistic modelling and simulations of the material development (WP4)

Vestel – Validation and End-User (Smartphone)

- ✓ System adaption and testing of the batteries
- ✓ Leading the validation and evaluation activities in the project (WP6)

CLEANCARB – SME – Energy Storage Systems

- ✓ Leading the definitions of battery specifications (WP2)
- ✓ Market analysis (WP7)

FAAM Research Center – Italian Battery Producer

- ✓ Identifications of components and cells specifications (WP2)
- ✓ Cell design and estimations of mass production (WP5)
- ✓ Testing and validations (WP6)
- ✓ Disseminations and exploitations (WP7)



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