

Energy Storage Research at GREENMat Lab

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Webinar & matchmaking event M-EraNet 2021

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➤ Where ?

University of Liège
(Belgium)



➤ What ?

Study and development of (new) materials with controlled microstructure and physical/chemical properties to enhance or facilitate their use in different applications related to

- **energy** (storage (batteries), production (PV), management (electrochromism)) ;
- **environment** (recycling of Si-based panels, recycling of materials from batteries,...) ;
- **health** (ceramic additive manufacturing),...

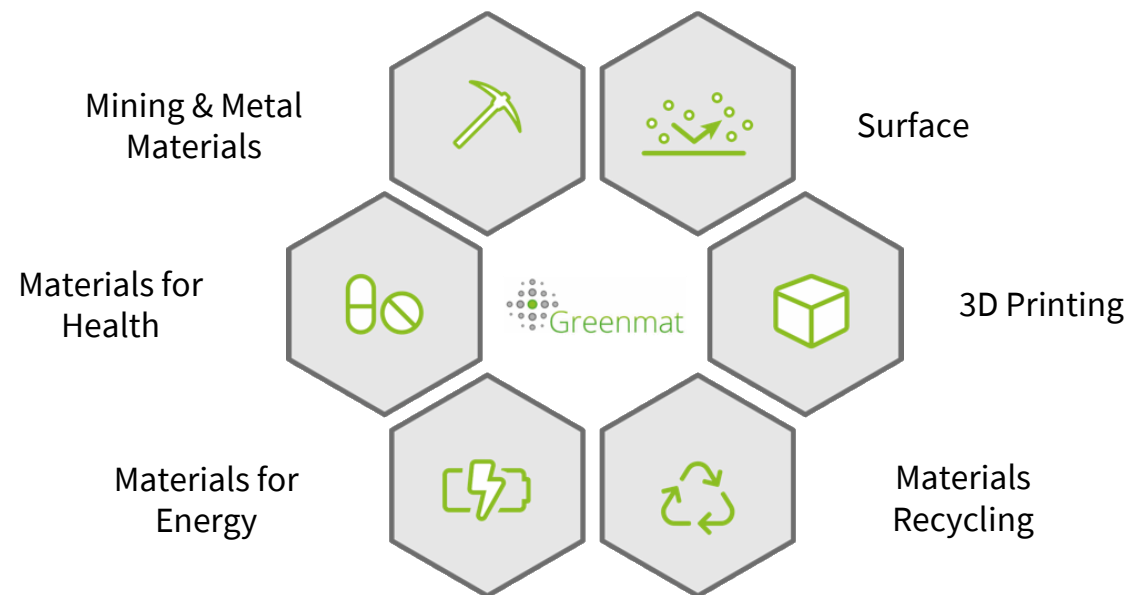
➤ How ?

Powders & thin film processing → up to pilot scale (spray-drying, hydro/solvothermal, additive manufacturing, spray deposition,...)

Advanced characterization techniques

➤ Who ?

Prof. Rudi CLOOTS (Director) / Dr Frédéric BOSCHINI (R&D Powder & Batteries Manager)
+/- 30 people (1/3 active in batteries)



➤ **Electric/Energy storage (Li-,Na-,K-,Zn-...ion batteries)**

- **Optimized synthesis (including recycling) of nano-/micro-sized powders** (oxides, phosphates, sulfates, Si/C, titanates, hybrid, ...) as **cathode or anode materials**

→ several **pilot units** for the green synthesis of powders : hydrothermal reactors (5.5 & 100 liters) and two spray-dryers (5 liters/h - aqueous or non-aqueous (ATEX) feed)

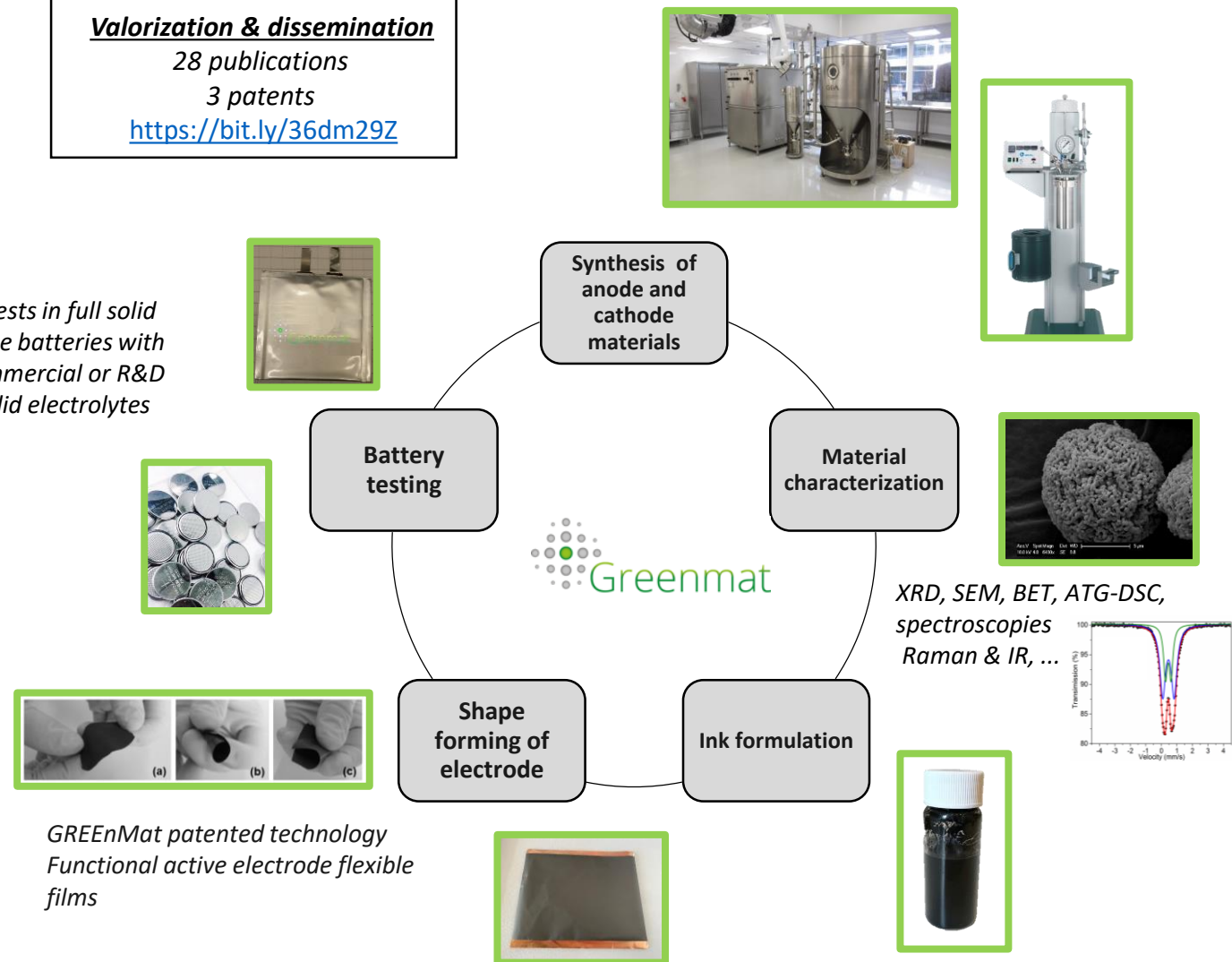
- Complete **physico-chemical characterization** of the designed **materials** (XRD, Mössbauer and Raman spectroscopies, TG/TDA, SEM, TEM, BET, particle size, liquid and powder rheology,...)

- **Development of formulations** (suspensions and/or slurries) for the **processing of layers** (by spray or tape-casting)

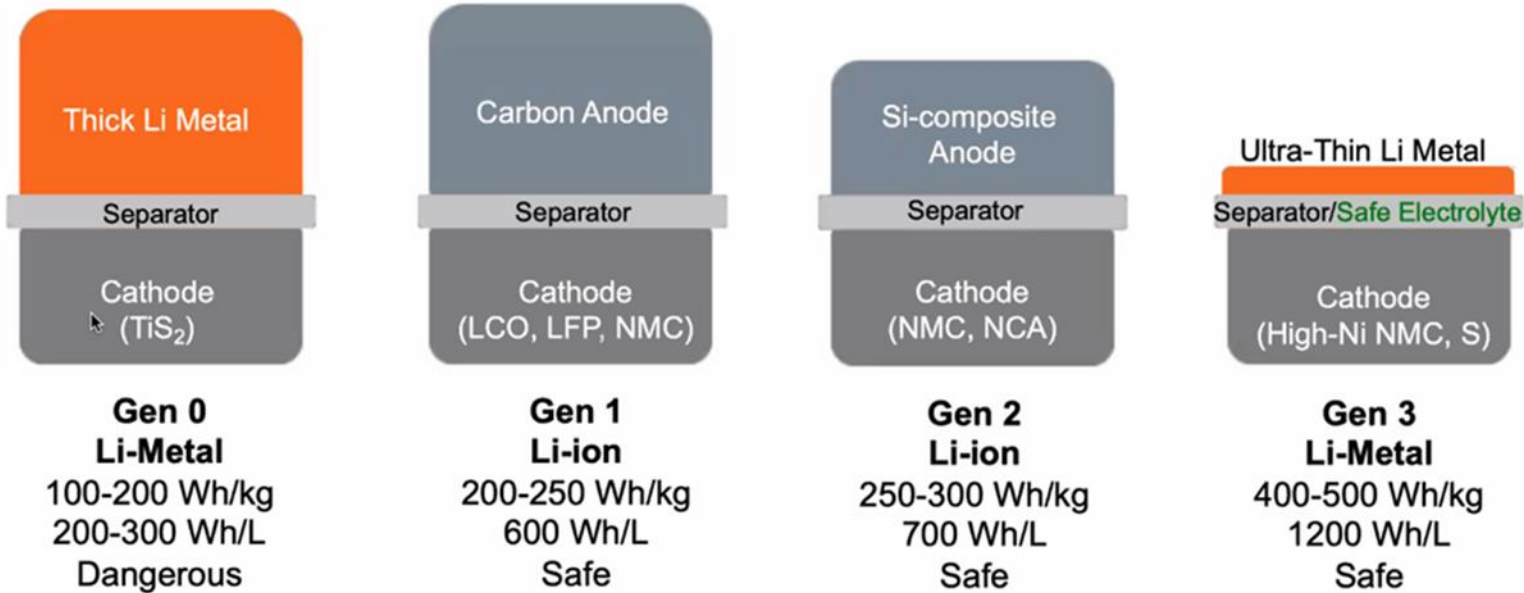
- **Cell assembly and electrochemical characterization of the materials** in half-cell and full-cell configurations (**coin and pouch cells**) + *in situ* characterization techniques (XRD, Impedance and Raman analysis)

Valorization & dissemination
28 publications
3 patents
<https://bit.ly/36dm29Z>

+ tests in full solid state batteries with commercial or R&D solid electrolytes



➤ Evolution & challenges



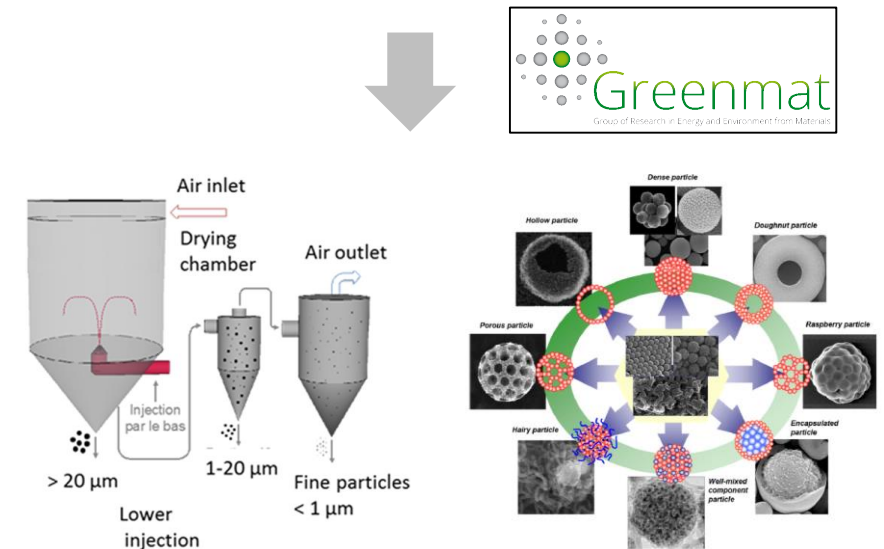
Reference: Battery 500 consortium

Advantages :

- Increase of the safety, energy density and cycle life.

Challenges :

- Low ionic conductivity of the solid electrolyte.
- instability of the solid electrolyte.
- Interfaces.

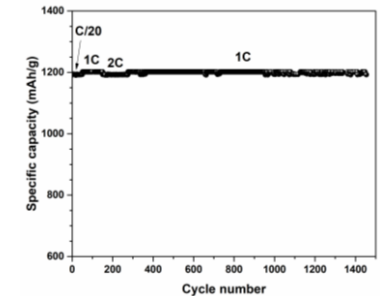
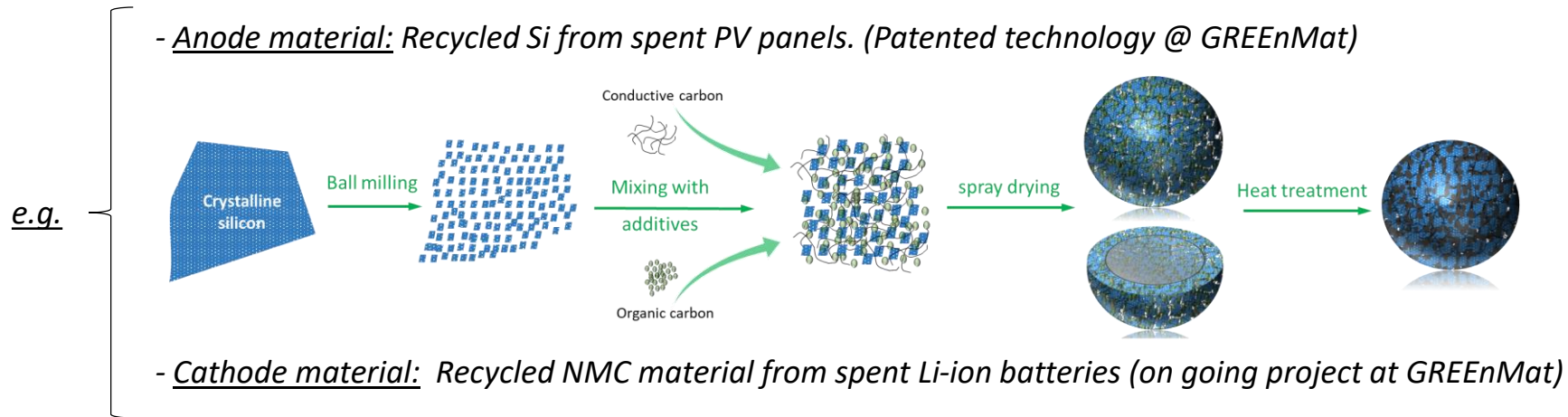


➤ PROJECT IDEA: DEVELOPMENT OF ALL SOLID STATE LI-ION BATTERIES BY SPRAY DRYING METHOD

Motivation: Increase the safety and the electrochemical performance



1- Synthesis of the anode and cathode materials for Li-ion batteries



Other partners ?

2- Solid Electrolyte: Oxides, Sulfides, Halides (spray drying (GREEnMat) and looking for collaborations)

➔ **Looking for any collaborative research or industrial partners in the field**

University of Liege – GREENMat (www.greenmat.uliege.be)



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Batteries @ GREENMat



Technology
Publications
Patents

