ULiège - GREEnMat
Your Partner for Materials in Energy Storage

INFORMATION ABOUT THE EXPERT

ORGANISATION	University of Liège - GREEnMat
ADDRESS	Allée du 6 Août, 13 - 4000 LIEGE (BELGIUM)
TYPE OF PARTNER	University
WEBSITE	www.greenmat.uliege.be

CONTACT PERSON	Dr Frédéric BOSCHINI
EMAIL	frederic.boschini@uliege.be
TELEPHONE	+32 (0)496 42 36 12
POSITION	R&D Powder Manager

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EXPERTISE OVERVIEW

Topic(s) of interest:
LC-BAT-1-2019 : Strongly improved, highly performant and safe all solid state batteries for electric vehicles
LC-BAT-2-2019 : Strengthening EU materials technologies for non-automotive battery storage
LC-BAT-5-2019 : Research and innovation for advanced Li-ion cells (generation 3b)
LC-BAT-6-2019 : Li-ion Cell Materials & Transport Modelling

HEADLINE:
Synthesis (up to pilot scale) and characterization of anode/cathode materials + battery assembling/testing

POTENTIAL CONTRIBUTION:

GREEnMat - a chemistry research laboratory - is specialized in the **optimized synthesis of nano-/microsized powders** (oxides, hybrid, ...) as cathode or anode materials, the **development of formulations** (suspensions and/or slurries) for the **processing of layers (by spray or tape-casting)** to be **assembled into** batteries (from **coin to pouch cells**).

GREEnMat is the only Belgian university laboratory able to **produce and evaluate** inorganic materials for Na- and Li-ion batteries from laboratory to pilot scale (grams to kilograms) with its own equipment.
It is indeed equipped with several **pilot units** for the **green synthesis of powders**: a hydrothermal reactor (5.5 liters) and two spray-dryers (5 liters/h - aqueous or non-aqueous (ATEX) feed). GreenMat has also equipment for the **deposition of the electrode or electrolyte materials** (Spray and Doctor Blade).
GREEnMat aims at preparing (new) materials with well controlled morphology and at **reducing use of critical raw elements (using Fe, Mn, P, S, Si,** .....) by **green processes.**
Different synthesis conditions and electrode preparation parameters are tested to **maximize energy and power density and to improve the overall system cyclability.**

GREEnMat has also an extensive expertise in **material characterization** and is equipped for :
(i) the complete physico-chemical characterization of the designed materials (XRD, Mössbauer spectroscopy, scanning/transmission electron microscopes, TG/TDA, SEM, TEM, BET, Raman spectroscopy, etc.)
(ii) the cell assembly and **electrochemical characterization** of the materials in half-cell and full-cell configurations (**coin cell and pouch cells**).
GREEnMat has capabilities to **manufacture prototype cells** or **cell components with distinctive features.**

All obtained materials are thoroughly analyzed using electrochemical techniques (galvanostatic cycling, cyclic voltammetry and impedance spectroscopy). GREEnMat is also experienced in the study of the reaction mechanisms operating during the discharge/charge processes of electrode materials by ***operando*** and ***in situ*** **techniques** (XRD, impedance and Raman spectroscopies).

Today, the laboratory is involved in 6 national **research projects** related to the synthesis and the development of new materials for Alkali-ion batteries. Two projects are dedicated to **recycling** of silicon wafers from solar panels and to use extracted Si material as anode material for Li-ion batteries which led dispersed nanometric Si particles in carbon matrixes. Si/C electrode shows 100% of capacity retention (1200 mAh/g) after more than 1400 cycles (under patenting) at 1C.
Two projects are devoted to the synthesis of new phosphate materials by solvo/hydrothermal reactions. Another project is focusing on the development of polyanionic electrodes for Na-ion batteries.
Other projects led to a **patent** on the **design and manufacturing of thin flexible batteries.** The working electrode was based on LTO prepared by spray drying method. The flexible electrode delivers a specific capacity of 175 mAh/g (100% of the theoretical capacity) and 145 mAh/g (85% of the theoretical capacity) at C/4 and 1C respectively.
Finally, a new project just started on the development of a **pouch cell line**.

Download here our brochure where you can find an overview of our research topics and information about our pilot-scale equipment.

For more information about our energy storage research click here.