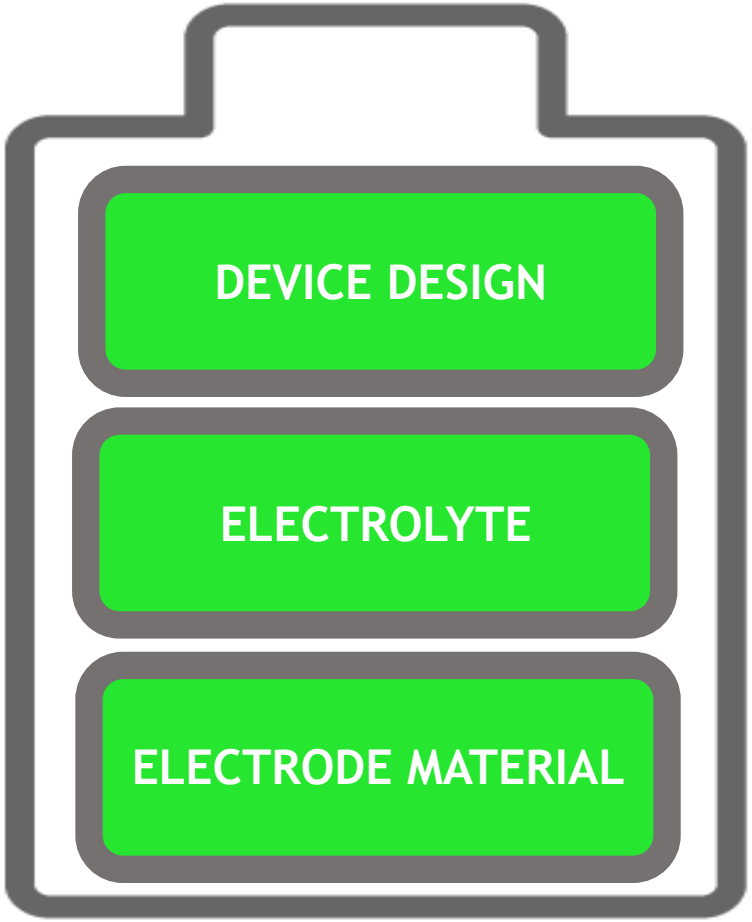
Bringing you the future
of nanomaterials

01. Introduction. ESS devices development



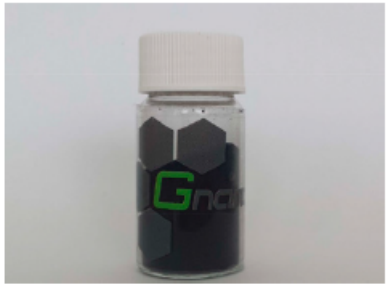
Design and incorporation of new ways to assemble devices, costs optimization, etc.

Optimization of the parameters of the electrolyte to improve device performance

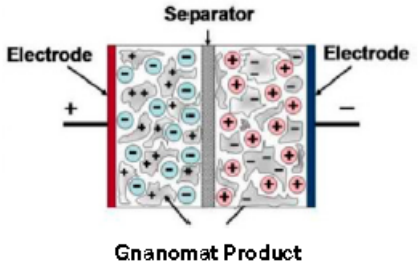
Optimization of the materials to improve electrochemical features. Very few advances in the last decades in this factor. Most of the producers are using the same material for decades (active carbon, graphite, etc.)

Great opportunity of ESS developers to improve one of the key componentsby the optimization of electrode materials through nanotechnology.

02. Gnanomat value proposal



Development
Product Manufacturing



Electrode Preparation

Electrode assemble in final device
Commercialization

GNANOMAT

ESS Manufacturer

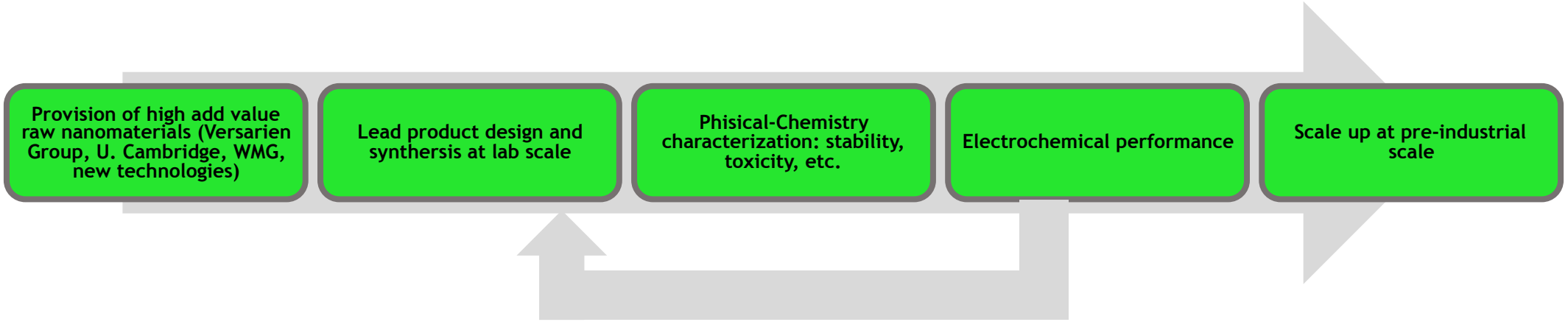
Gnanomat develops, optimizes and manufactures a new generation of nanomaterials.
Our proposal is based in the development of these material in early and close collaboration with the final partner in order to plan the nanomaterial optimization in the right context: the device of the final customer.

03. Our Unique Selling Points

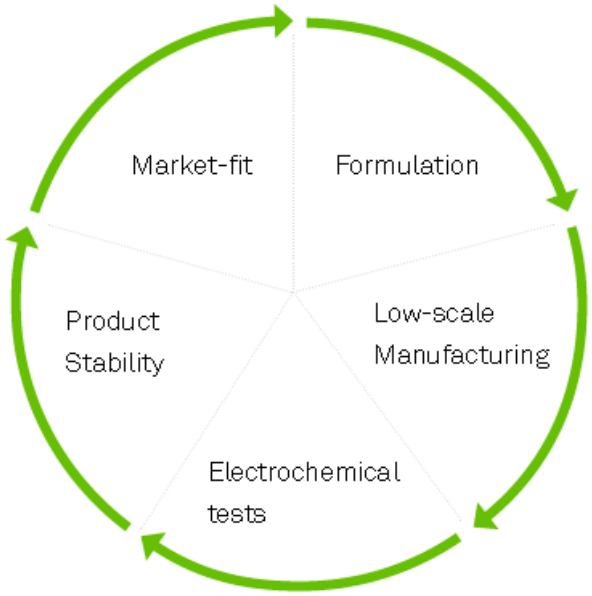
1- Gnanomat counts on a proper technology based on the optimization of hybrid nanomaterials made up by a carbon pase (Graphene, carbons, etc.) and nanoparticles rather disruptive and differential

2- Integration of all the activities required to complete the value chain of nanomaterials development to ESS.

3- Gnanomat Product Development Process (quality, procedures, multidisciplinary and trained team) highly optimized and very focused to final customer results.



04. Product Development Strategy



Optimization of formulation	Deep functional analysis
Nanomaterials structural studies (qualities)	Electrochemical characterization
Synthesis optimization at low scale	IP Management

Pre-industrial manufacturing
- Quality
- Costs

Device Model Tests
- Performance

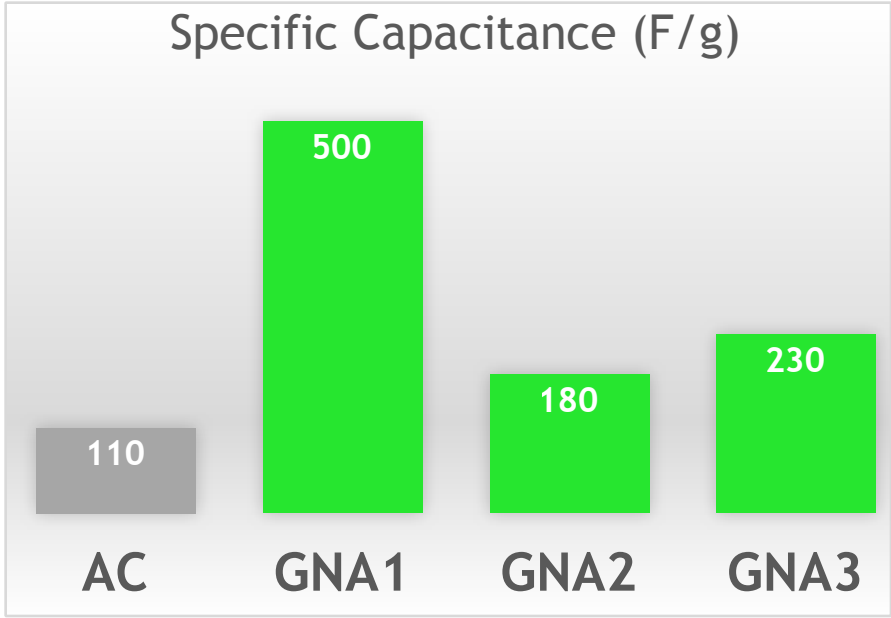
Gnanomat is willing to introduce the critical step of performance in final device with our partner-of-choice to focus the development efforts in specific applications and specific target devices. With this strategy the value chain from the nanomaterial development to final commercialization will be completed.

05. Our Track Record: Optimization of Graphene nanomaterials for Supercaps

OUR OBJECTIVE:
The market standard product in Supercaps is the active carbon (AC). Our target was to improve the performance of this material using alternative electrode materials based on Graphene.

GNANOMAT NANOMATERIAL DEVELOPMENT:
Gnanomat iterate in the development, optimization and test of new formulations to get new hybrid materials from Graphene to beat the standard of market (GNA1-GNA3). We focused our developments to improve capacitance at lab scale. The product showed disruptive performance of over 400% capacitance

NANOMATERIAL OPTIMIZATION:
From this point, Gnanomat make the nanomaterial fully viable to bring it to the final market optimizing other relevant functional parameters. In the table is showed improvements made to optimize cyclability (work in progress).



Sample	C (F g^{-1})	% Retention
AC	110	90
GNA #1	**553**	50
GNA #2	**174**	**95**
GNA #3	**238**	47

06.1 Capacities. Development of Nanomaterials for ESS Laboratory

- **Electrodes preparation**
- **Analysis of electrochemical properties of nanomaterials.**
- **Preparation of nanomaterials and nanoparticles.**

LAB EQUIPMENT

- **Thermogravimetric analyzer.**
- **Potentiost**
- **Glove box**
- **Peristaltic pump**
- **Magnetic stirrer plate**
- **Heating blanket**
- **Rotatory evaporator**
- **Precision balance and scale.**
- **Hydraulic pressUltrasound equipment**
- **Turbidimeter**

Gnanomat has a laboratory to prepare simples at low scale. These facilities count on all the equipment and team trained to manufacture, analyze and develop nanomaterials following its quality standards.

06.2 Capacities: Pilot Plant of Nanomaterials for ESS

GNM pilot plant is designed to produce nanomaterials using wet chemistry. The plant is capable to carry out multiple synthesis routes including:

<u>Bottom-up</u>

- Co-precipitation.
- Sonochemistry.
- Sol-gel (assisted or not by ultrasound).
- Microemulsions.

<u>Top-down</u>

- Ultrasound dispersion
- High Shear Mixing

PLANT CAPACITIES

- Production up to 250 Kg/year of nanomaterials; Batch working range from 1L to 100L.
- 2 reactors with controlled temperature and agitation.
- Ultrasound device up to 2,000 W.
- High Shear Mixing 30,000 rpm.
- Filter plate up to 10 plates.
- Manual or semiautomatic operation.
- Multiple data acquisition in-real time using SCDA software.
- Several of operation conditions allowed: 10-150ºC, 1-6 bar and 1-14 pH

06.3 Capacities: R&D Team

Gnanomat has a multidisciplinary team of professionals that covers the following fields:

- **Nanotechnology**
- **Electrochemistry**
- **Chemical engineers**
- **Quality**

06.4 Capacities: Key collaborators