

PRESENTATION

2024



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- Graphenano Plastics
- Graphenano Hydrogen Cell
- Graphenano Nanochips
- Graphenano Leather

WHAT IS GRAPHENE?

NANOMATERIAL

Its dimension is less than or equal to one millionth of a millimeter.

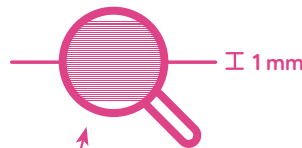


0,142 nm

Carbon atoms are tightly bound together in a uniform, honeycomb-like surface.

TWO-DIMENSIONAL

It has only two dimensions as it is only one atom wide (10^{-9} mm).

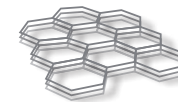


3 million of stacked graphene sheets

1 mm

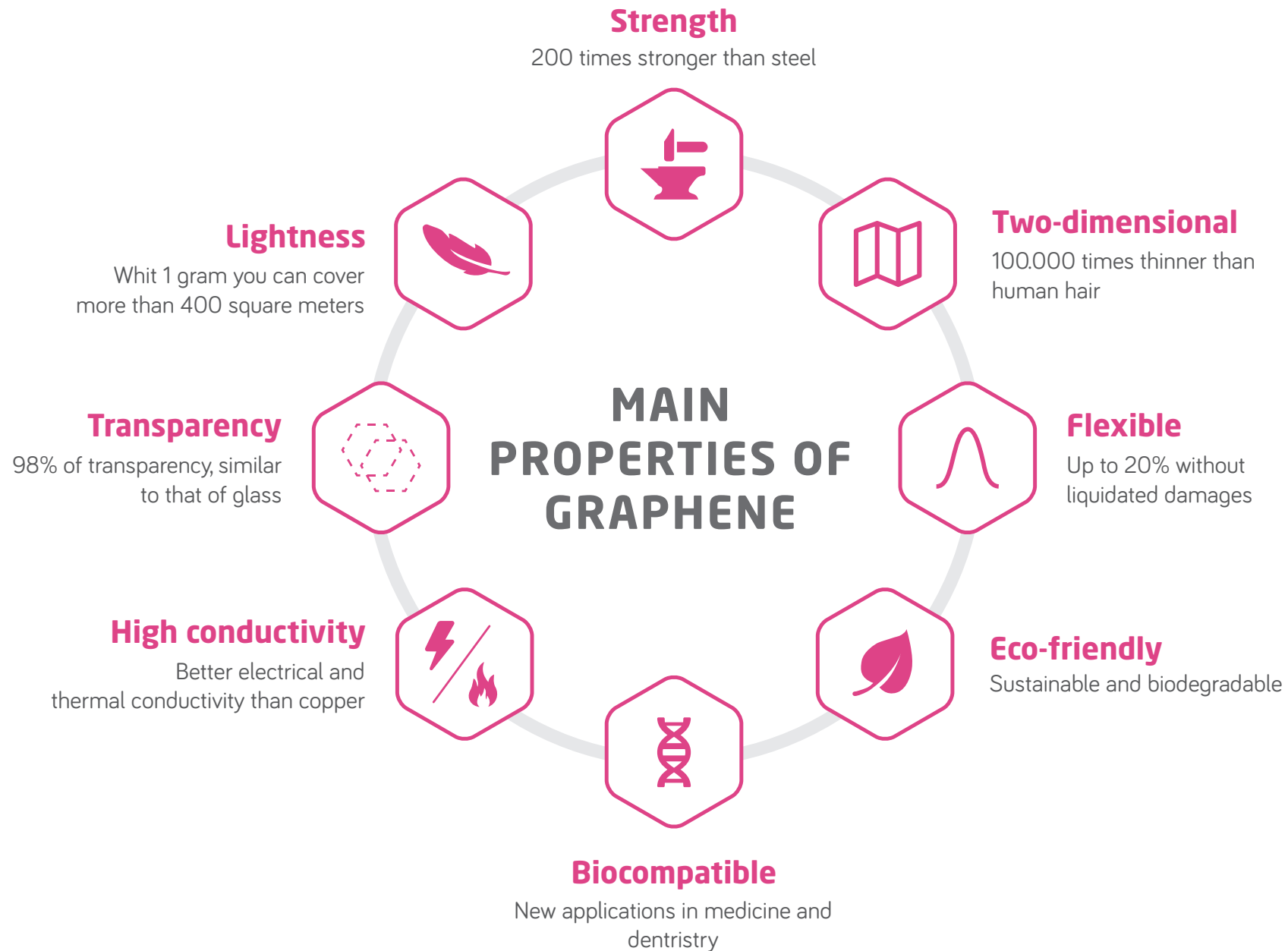
PURE CARBON

Such as *graphite** and diamond.



* *Graphite* is composed of many sheets of graphene stacked on top of each other.

It is not surprising that graphene, as a substance with more electrical and thermal effects, conductivity, mechanical strength and optical purity than any other, is being heralded as the “wonder material” of the 21st century, just as plastics were in the 20th century





GRAPHENANO GROUP

Group description and corporate structure

The Group

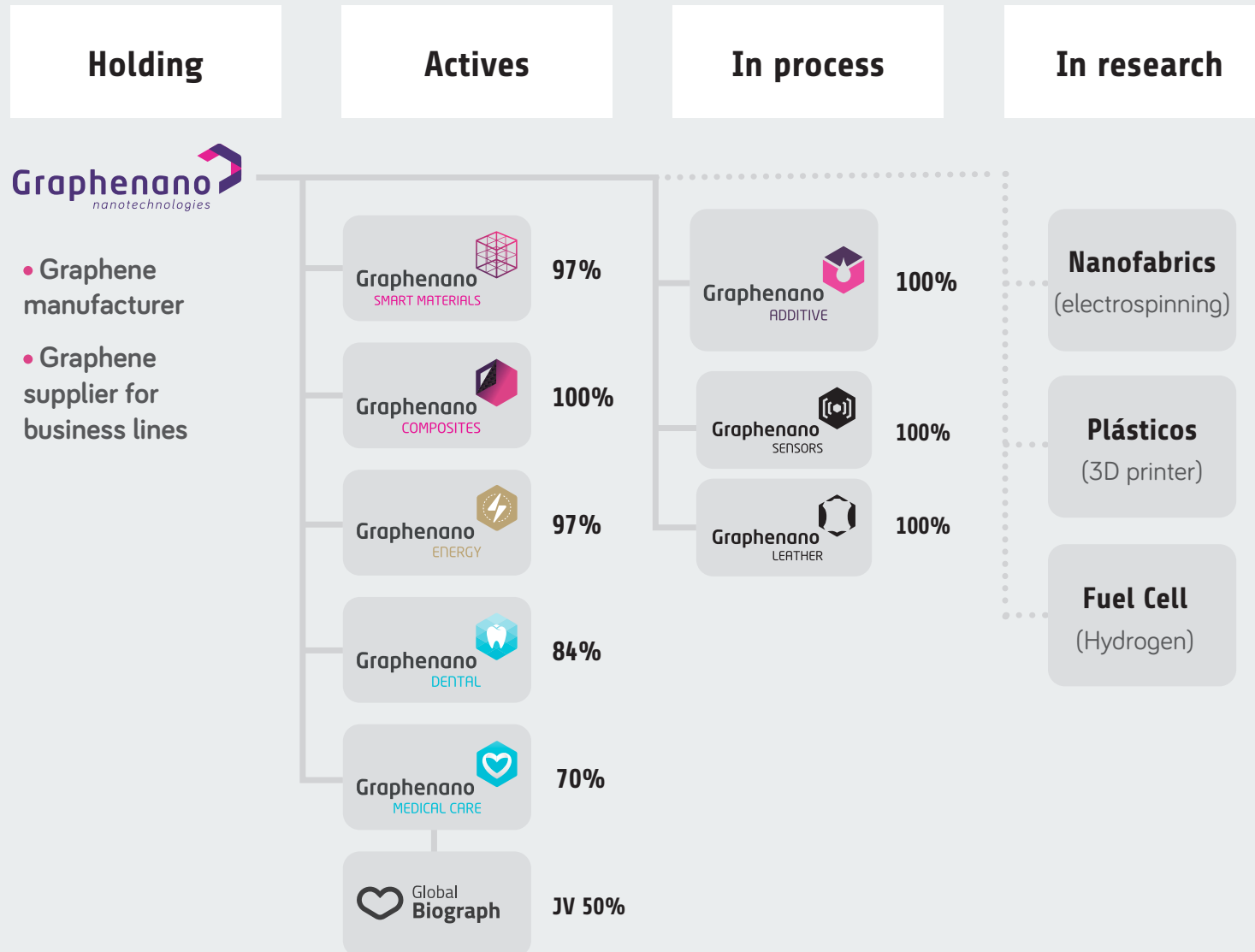
Graphenano is a leader in the manufacture of high quality graphene; and the integration of graphene into other products.

Graphenano is not selling graphene as a raw material as the added value is in the application, therefore it acts as a supplier to its subsidiaries.

The business model is based on developing graphene applications (Research + Development “R+D”) involving researchers/universities with which a financial agreement is reached.

The Group supplies a wide range of end markets (construction, marine, wind energy, automotive, dental and personal care, among others).

BUSINESS LINES AND CORPORATE STRUCTURE



GRAPHENANO GROUP STRUCTURE

-  Graphenano Production Plant 1 (Yecla)
Graphenano Office (Yecla)
-  Graphenano Composites (Yecla)
-  Graphenano Additive (Yecla)
-  Graphenano Smart Materials R&D (Yecla)
-  Graphenano Dental (Paterna)
-  Medical Care R&D (Alcalá de Henares)



2. ACTIVE BUSINESS LINES



Graphenano
SMART MATERIALS

Graphenano

SMART MATERIALS



PRODUCT SERIES

Smart**COVER**
GRAPHENE FINISHING 

Smart**ADDITIVES**
GRAPHENE CONCRETE

Smart**CONCRETE**
GRAPHENE ADDITIVE

Smart**MASTER BASE**
GRAPHENE ADDITIVE

FloorGraphene
Smart**ADDITIVES**
GRAPHENE CONCRETE 

The Smart Additives line of admixtures is designed to transfer the mechanical properties of graphene to concrete, offering improvements in compressive strength of more than 30% and flexural strength of more than 45%



FLOOR GRAPHENE

Within our line of additives, it stands out at the present time for the advantages for energy saving in the place where it is applied, and the saving of CO₂ emissions that it entails.

It is a hyperplasticising additive based on new graphenano technology with high thermal conductivity performance, reducing water consumption.

- Improved thermal conductivity.
- Improved mechanical performances.
- Improved durability.
- High water-reducing power.

Thanks to the improved performance of the concrete by incorporating graphene, the need for cement is lower, which can be reduced by up to 30% less to carry out the same construction.

Material	Annual Cost (€/year)	Economic savings (€/year)	CO ₂ emissions	Environmental savings kg CO ₂ /year
Lime and Cement Mortar	8,996	-4,498	16,493	+8,246
Cement Mortar	4,498	-----	8,246	-----
Anhydrite Mortar	3,482	+1,015	6,384	-1,862
GMB Mortar	2,698	+1,799	4,948	-3,298

Example of use Conductive graphene additive in 125m².



SmartCOVER *μ*
GRAPHENE FINISHING

Micromortar coating technology Graphene

SmartCOVER *μ*

GRAPHENE FINISHING

SmartCOVER is a new formulation that includes an improvement of the mechanical and environmental characteristics of conventional micro-mortar thanks to the incorporation of graphene additive in its composition.

It is an innovative micro-mortar, reinforced with graphene, which achieves the highest qualities of hardness in the face of impacts and frequent foot traffic. Its resistance, elasticity and impermeability are unique compared to traditional cements and mortars.

SmartCOVER is a decorative coating suitable for all types of surfaces. Its application thickness is a thin layer of 2 to 3 mm which provides great adherence. The result is continuous surfaces, free of cracks and joints, with a marbled effect and a wide variety of colours and finishings.

Since it does not generate annoying “debris”, it can be applied directly on walls and floors, interiors and facades, swimming pools and showers, kitchen and bathroom countertops, etc. Furthermore, it can be applied on any type of material, such as cement, plaster, plasterboard, tiles, marble, porcelain tiles, wood, etc.

Being pore-free and jointless, SmartCOVER requires no specific maintenance and is therefore quick, easy and convenient to clean.



Higher strength



Impact hardness



Impermeability



Bactericidal effect



Flexible



Conductivity



Greater durability



Better workability



A line of additives with graphene technology for concrete for:

- + Residential Building
- + Prefabricated
- + Civil Works and infrastructures

Some of the advantages:

- + 150 years of useful life
- + Up to 50 years without any (pathologies or need for maintenance or repair)
- + Improvement of earthquake safety
- + Cement consumption reduction up to 30%
- + Environmentally friendly: REDUCES CO₂ EMISSIONS



Greater strength



Greater hardness



Greater elasticity



Greater lightness



Higher conductivity



Longer durability

Graphene-based materials have a particle size of nanometers (nm) that occupies pores in the concrete that were previously occupied by air. This, graphene gives concrete its hydrophobicity, preventing water from entering by penetration or absorption. This phenomenon gives the concrete improved durability, prolonging its useful life and, at the same time, reducing maintenance costs.

SmartMaster Base

Water-based graphene nanodispersions for integration in manufacturing processes of additives for concrete and construction products.

These solutions are specially designed for manufacturers of products in the construction sector, and can in any case be configured and adapted to the manufacturing processes and requirements of each manufacturer.

Graphenano's technology provides improvements in mechanical performance, durable performance and maximum polymer efficiency and technologies in which it is used.

SMART CONCRETE NEW DEVELOPMENTS

Smart Concret special concretes cover the needs of certain non-standardized specifications for certain special projects based on their design and application characteristics. These are high-performance concretes that incorporate Smart Additives with graphene technology in their formulation, which provide the structures with qualities of resistance, sustainability, lightness and durability that are unattainable with conventional concretes

Lightened concretes with structural resistances

Weight-reduced standard concrete

Only with water, cement, graphene additives and light aggregates, e.g. perlite, pumis, etc. Fine aggregates such as sand and gravel are not required.

Density

1400-1600 kg / m³

Compression Resistance

25 a 45 N / mm²

Relation a / c

0,46

Consistency

> 93 cm

Value K

> 0,33 W / mK

Noise protection

> 53 dB

Concrete with desert sand

Concrete designed with desert sand.

Only with water, cement, graphene additives and desert sand. Fine aggregates such as sand and gravel are not required.

Standard Concrete

Density

2400 - 2500 kg / m³

Cement Content

270 - 280 kg / m³

Force Compression

35 a 40 N / mm²

High Performance concrete

Density

2400 - 2500 kg / m³

Force Compression

+ 90 N / mm²

Cement Content

360 - 380 kg / m³



CERTIFICATIONS

Graphene is a carbon-based nanomaterial much stronger than steel and hard like diamond, capable of withstanding large loads and absorbing energy before breaking. Hence, concretes containing this material have greater tensile strength and are more resistant to compression and wear. In addition, they are concretes that have great flexibility and ductility, delaying the appearance of cracks and fissures, which makes them ideal in seismic zones and against other natural disasters. Constructions built with these concretes that contain graphene additives can increase their useful life by up to 50 years compared to those that contain conventional materials.



International patent

Graphenano has patented SmartADDITIVES technology for graphene-based concrete admixtures globally.



CE marking

AENOR accredits us with the CE marking of additives regulated under standard: EN 934-2: Additives for concrete and mortar, according to the 2+ evaluation system and the applicable harmonized standards.



EPD (Environmental Product Declaration)

EPD (Environmental Product Declaration) certification accredited by the International EPD System for two of its product lines: Concrete Additives and GMB.





Graphenano Composites is the company of the Graphenano group, responsible for the development and marketing of products for different sectors in the field of composites.

With the aim of making the most of these years of research and knowledge, Graphenano Composites has developed a new generation of composites with graphene that opens the door to an infinite number of applications.

Thanks to the use of Poligraph Plus, Vinilgraph Plus and Epograph resins, composites can exponentially improve their technical properties, such as:



Strength



Lightness



Hardness



Flexible



Elongation



**Fire resistance class
A in pultrusion**



**Electrical
conductivity**



Impermeability



**Bacteriostatic
effect**

COMPETITIVE ADVANTAGES

Thanks to their improved mechanical properties, composites made with CompoGraph resins make the applications that use them more efficient, which also benefits the companies that use them with a series of competitive advantages::

Product quality

- The final quality of the application is far superior to any other application made with traditional composites available on the market.

Versatility of application

- The unique properties of graphene extend the application fields of composites to other sectors such as medicine, dentistry, shipbuilding, etc.

Cost savings

- Reduction of raw materials. Raw materials can be reduced by 20 % to 60 % (depending on the material) to achieve the same average characteristic yield.
- Use of more economical resins. Our glass-filled polyester resins match the properties of higher priced resins.

Environmentally friendly

- More ecological and environmentally friendly production processes, largely due to the reduction of raw materials, mainly derived from petroleum.
- Elimination of hydrolysis, and all the problems it entails.
- Minimisation of wastage. Thanks to the conductivity of graphene, thermal production processes are improved (isothermal).



RESINS

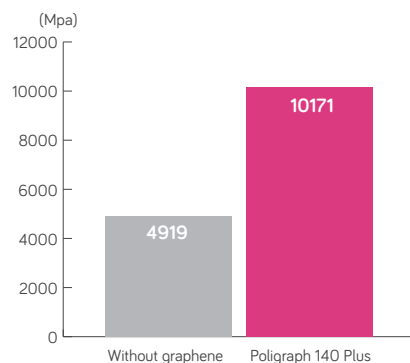
Graphenano Composites

POLIGRAPH 140 PLUS

POLIGRAPH 140 PLUS is a state-of-the-art orthophthalic polyester resin modified with graphene nanotechnology, for use in the manufacture of nanohybrid composites that considerably increase their mechanical, physical and biological properties. It is a fully polymerisable resin with medium reactivity. It has high temperature and fire resistance.

POLIGRAPH 140 PLUS is pre-accelerated with cobalt salts and contains a toxicotropic and UV protection agent.

Flexural strength (ISO 14125)

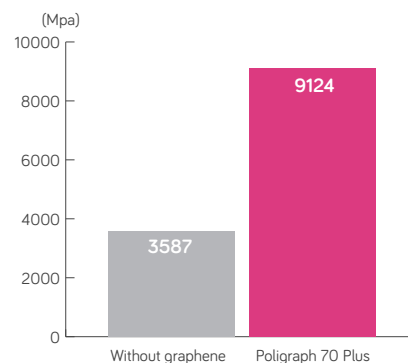


POLIGRAPH 70 PLUS

POLIGRAPH 70 PLUS is an isophthalic polyester resin of the latest generation modified with graphene nanotechnology, for use in the manufacture of nanohybrid composites that considerably increase their mechanical, physical and biological properties. It has excellent water, temperature and fire resistance.

POLIGRAPH 70 PLUS is pre-accelerated with cobalt salts and contains a toxicotropic and UV protection agent.

Flexural strength (ISO 14125)

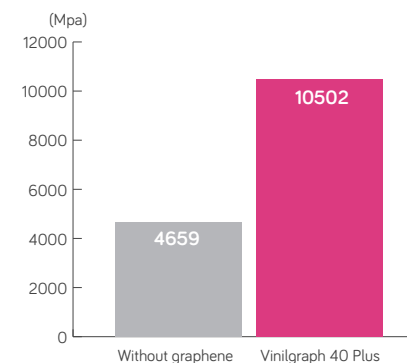


VINILGRAPH 40 PLUS

VINILGRAPH 40 PLUS is a state-of-the-art vinylester-type resin modified with graphene nanotechnology, for use in the manufacture of nanohybrid decomposites that considerably increase their mechanical, physical and biological properties. High chemical resistance, excellent corrosion resistance, as well as excellent reaction to fire.

VINILGRAPH 40 PLUS is pre-accelerated with cobalt salts and contains a toxicotropic and UV protection agent.

Flexural strength (ISO 14125)

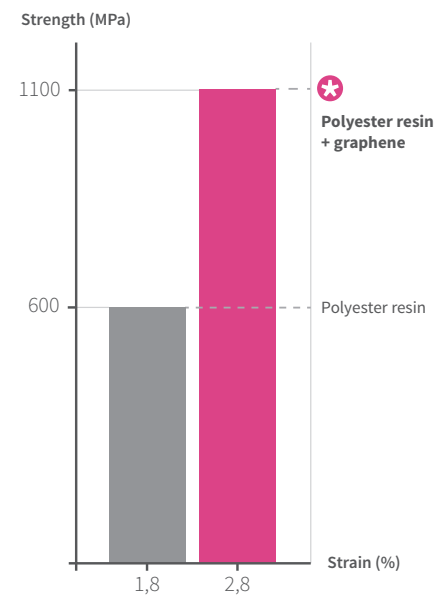




One of the important applications of our composmart graphene resin is for pultrusion, the manufacture of glass fibre reinforced resin profiles doped with graphene additive.

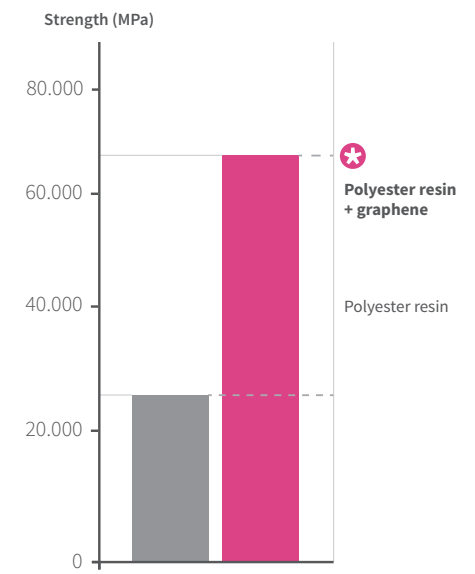
Graphene improves on traditional profiles in terms of strength, lightness, structural rigidity, protection against hydrolysis and bacteria, and increased durability of the material.

FLEXURAL STRENGTH (PULTRUSION)



Test according to standard
UNE-EN ISO 14125.

ELASTIC MODULUS (PULTRUSION)



Test according to standard
UNE-EN ISO 14130.



Port of Barcelona Potash Warehouse. 40.000 linear metres made with graphene Pultrusion.

CURRENT PRODUCT RANGE



VYNILGRAPH/REINFORGRAPH 901 PLUS PREMIUM

The best resin of its category in the world.

Bisphenol A type epoxy vinylester resin with graphene, of medium viscosity and reactivity. It is preaccelerated with cobalt salts. It provides excellent corrosion resistance to a broad range of organic and inorganic acids, alkalis, oxidizing chemicals and salt solutions, etc. It also provides very good mechanical strength such as tensile and flexural while incorporated with reinforcement such as glass fiber, carbon fiber, etc.

Cost savings

- Reduction of raw materials. Raw materials can be reduced by 20 % to 60 % (depending on the material) to achieve the same average characteristic yield.
- more economical resins Our vinylester resins match the properties of higher priced resins.

Environmentally friendly

- More ecological and environmentally friendly production processes, largely due to the reduction of raw materials, .
- Minimisation of wastage. Thanks to the conductivity of graphene, thermal production processes are improved (isothermal).





MAGNEGRAPH A & B

Magnetizable epoxy vinylester type resin with graphene, high viscosity and medium-low reactivity. It is pre-accelerated with cobalt salts. It provides an excellent magnetic field of 140-250 G, the base resin has high resistance to corrosion and chemicals, as well as excellent mechanical characteristics. The anchorage to ceramic pieces is high, forming a monolayer with the pieces and with a high surface hardness.

Properties

- Magnetizable, allowing magnetic adhesion to the wall with the Magnegraph A product..
- Very good adhesion and high resistance on ceramic pieces..
- It obtains enough magnetic field to leave it in wall and floor magnetic systems..
- Excellent mechanical and chemical performance..

Applications

- It is specially designed as a magnetic part in resin for ceramics, marble...
- It has good adhesion and very low linear and volumetric shrinkage.
- The percentage of mek peroxide that must be added varies between 0.4% and 0.5%, although it can be increased to reduce gel time..
- Application can be manual or machine.
- It can be used in the ceramic industry.



LEATHER TANNING ADDITIVE

- Additive for tanning leather. Improvement of mechanical properties by reinforcing the weak points of the leather. Elimination of contaminating products in tanning processes such as Chromium..



ADDITIVE FOR OVEN ELECTRODES

- Energy savings due to the conduction of the electrodes made with graphene.

- Without Graphene

3.9657 k Ω

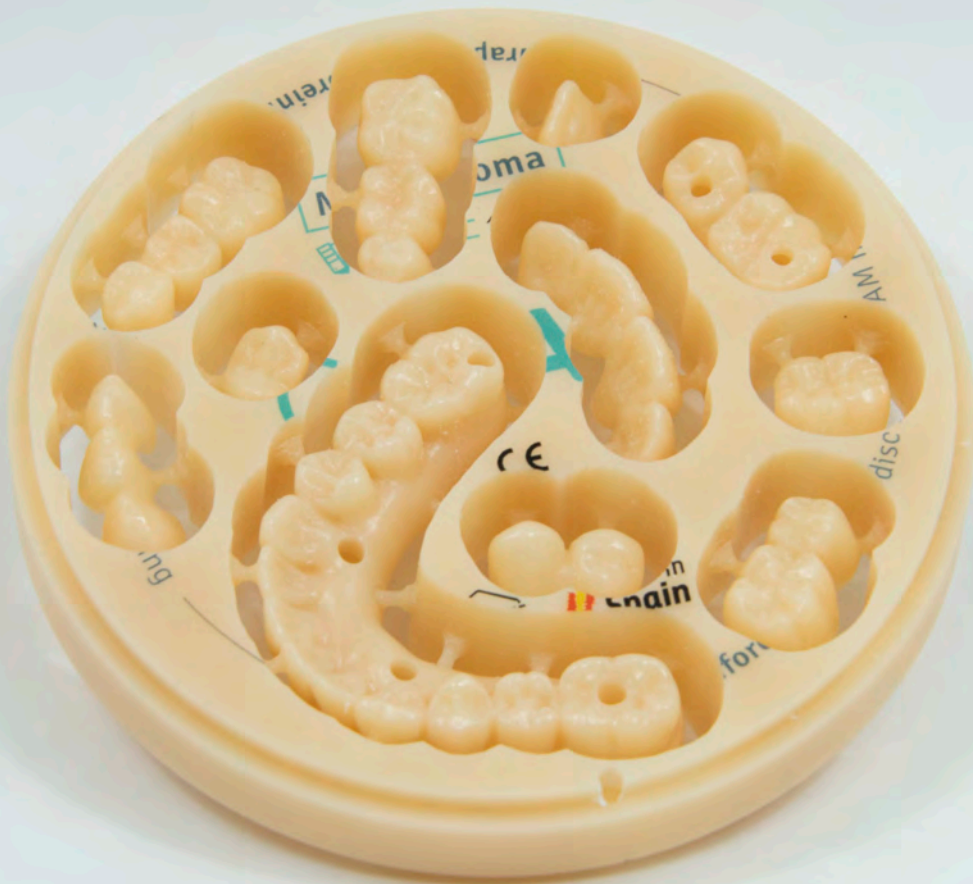
99,7%
improvement

- WITH GRAPHENE

13.2083 Ω







G-CAM

Graphenano Dental's first product is **G-CAM**, a biopolymer disc nano-reinforced with graphene, specially designed for permanent dental structures, which solves all the mechanical, physico-chemical and biological deficiencies of the other materials used in the sector.

- The G-CAM disc has a wide colour range, even in a single piece, **making it extremely natural**.
- It has a high glass transition temperature which **prevents softening and distortion** during use and cleaning.
- Graphene **improves the dimensional stability** of polymers for dental use, allowing the dental prosthesis to remain dimensionally stable over time.
- Thanks to the graphene, it improves its strength relative to its weight. The **density of the material is low** so that the prosthesis is lightweight.
- It is a translucent material that allows **high transparency** to mimic the natural aesthetics of the tooth.
- It is a **totally watertight and stable** material that does not allow the accumulation of tartar, as well as preventing the accumulation of dirt and colour staining..

The product is in the process of obtaining FDA license for USA, and has CE Marking.



Zirconium



Metal-Ceramics



G-CAM





G-CAM Advantage

Technical advantages

- Chemical
- Mechanics
- Biological

Economic advantages

- Simplifying work
- Largest number of parts
- Reducing working time
- Lower cost per part

	G-CAM	Zirconium
Tooth pieces	30 / 34	20 / 22
Working time	3,5 h	11 h
Tooth	5,30 €	11,36 €



New Products



G-BLOCKS



G-PRINT Graphene resin for 3D Model



1. Certified technical achievements

Quality and technical certifications

- + CE and FDA Certificate
- + Sanitary product licence
- + Genotoxicity test
- + Cytotoxicity test
- + ISO 13485 standard



Universidad
de Alcalá



UNIVERSITAT
POLITECNICA
DE VALÈNCIA



CEU
Universidad
Cardenal Herrera



SAPIENZA
UNIVERSITÀ DI ROMA

Patented technical achievements

- + Medical grade graphene





Graphenano Medical Care is dedicated to the research of biomedical applications of graphene. Currently, a Graphenano team is working together with the University of Alcalá in the research of graphene in different lines, some of them already patented and others in the process of obtaining or presenting a patent.

Some research suggests that graphene could repair blood vessels in cardiovascular disease, kidney damage by reducing dialysis time, and may even help destroy cancer cells.

1. Certified technical achievements

Quality and technical certifications

+ INCI (this is the registration of the biograph for use as a cosmetic ingredient).



Universidad
de Alcalá

UNIVERSIDAD DE
MURCIA



IVAMI

Patents achieved

- + Medical grade graphene (World Patent 12/20)
- + Cosmetic Grade Graphene (World Patent 12/20)
- + Drinkable graphene – Body fat loss



Selected lines of research

- + Hepatic and renal dialysis membranes
- + Neuronal cell regeneration (retinal, macula and nerve cells)
- + Suture threads
- + Patches for diabetic sores and for large burns
- + Healing gel
- + Pregnancy sensors
- + Glucose sensors

Launching line

- + Dermo-cosmetic line with our medical grade graphene BIOGRAPH



AcquaGraph



What is Biograph®?

Innovative patented active ingredient, based on cosmetic grade graphene

Biograph® is a bioactive developed and patented by the Spanish company Graphenano Medical Care, S.L.

It is a derivative of graphene, a substance of natural origin, highly biocompatible and safe.

The multiple studies carried out in specialised and approved external centres, as well as in different universities, certify the efficacy and safety of the product for its use as a cosmetic ingredient..

- ✓ In vitro studies
- ✓ In vivo studies, carried out on volunteers





AcquaGraph

Advanced cosmetic

The **world's first Biograph® cosmetic**
line, Biograph® grade graphene and
AcquaSea, the power of the sea

Scientifically and dermatologically
tested products





New electrode printing system for any energy storage system on the separator on both sides, thus avoiding the use of metallic collectors, such as copper, aluminium, steel, etc.

By treating the electrode inks with graphene carbonaceous materials, an optimum electrode conductivity is achieved for the chemical and electrochemical reactions to take place during the charging and discharging processes, without the need to use a metal collector as a support.

This new technology offers numerous advantages for energy storage systems, such as increased energy density, lower cost, higher cell voltage, etc.

DEVELOPMENT POTENTIAL

ELIMINATION OF THE USE OF COLLECTORS

Metal current collectors are one of the heaviest components of energy storage systems and are hence involved in the reduction of energy density (Wh/Kg).

Collectors are one of the most expensive components of a battery, especially nowadays with the problem of material supply and geolocation. Up to now, the solutions that have been proposed have been to reduce the thickness of the collector as much as possible in order to reduce its weight and price, however, no one has ever done away with it.

Thanks to our new technology, the electrodes of the energy storage systems can be printed directly onto the separator, which significantly improves their weight, price, and energy density.



ADVANTAGES

Advantages of using our development.

- Higher energy density: by avoiding the use of metallic collectors, considerably reducing the total mass of the device. As a consequence, the energy density per kg (W·h/kg) will be improved.
- Reduction of the final price: one of the most expensive components of energy storage devices are the metallic collectors (e.g. Cu, Al, Ni, steel), even more so today with the material crisis due to the war in Ukraine among other factors. This new technology makes these collectors unnecessary, and since they are replaced by cellulose-based inks (paper) and graphene fibres, the price will only depend on the cost of other materials such as electrolyte and electrode material.
- No collector oxidation/reduction problems: when the solvent in the electrolyte is organic, this does not usually cause oxidation problems in the collectors. Nevertheless, if water-based electrolytes are used (much more ecological and economical), the degradation of the collectors affects the stability of the storage devices (as it has been confirmed in the ICMol-Graphenano project for supercapacitors or alkaline batteries). Without metal collectors, we can overcome this problem.
- Increased cell potential: the use of metallic collectors leads to a very high localised conductivity on their surface, increasing the conductivity of the device, and thus its capacity. On the other hand, this high conductivity results in high localised potentials, which lead to the decomposition (oxidation or reduction) of the solvent in the electrolyte. Due to the graphene fibres hybridised with the electrode materials, we obtain an optimal conductivity (i.e. exceeding the percolation limit) for its correct behaviour without the metallic collectors. Hence, the high localised conductivity is avoided, and therefore, the cell potential can be increased by around 0.5V. In addition, this also improves the energy density, as the power is directly proportional to the voltage ($P=V \cdot I$).

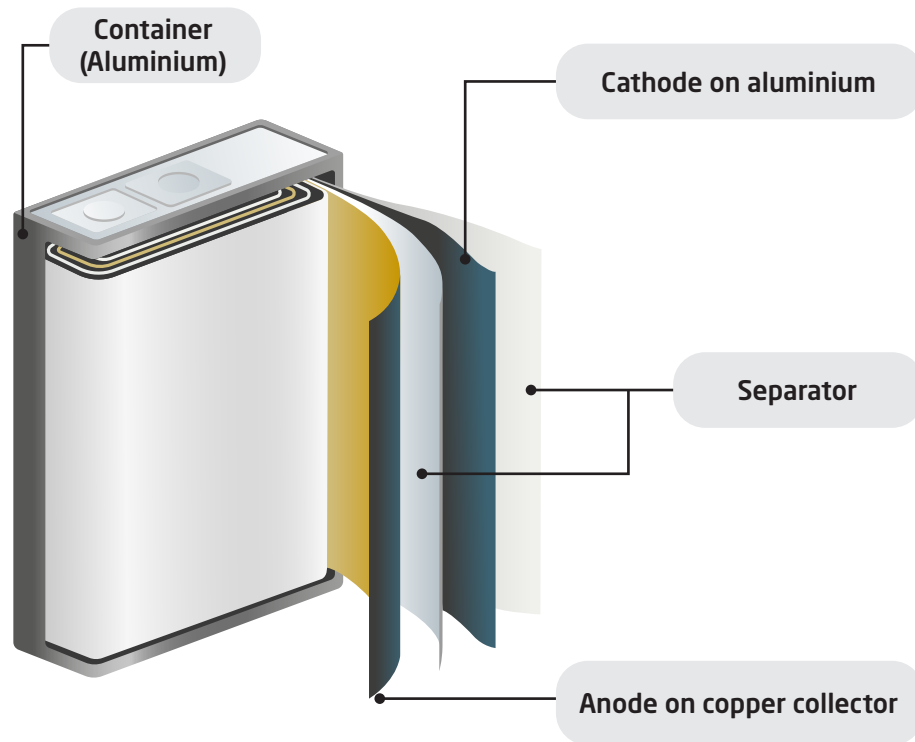
APPLICATIONS UNDER DEVELOPMENT

It is of interest to any company involved in the manufacture of energy storage systems, whether lithium batteries, sodium batteries, capacitors, supercapacitors, hydrogen cells, etc. As it is a very versatile technology for any storage system, the producer company could be able to market its products with the same (or sometimes better) performance, but at a much cheaper cost and better energy density per kg.

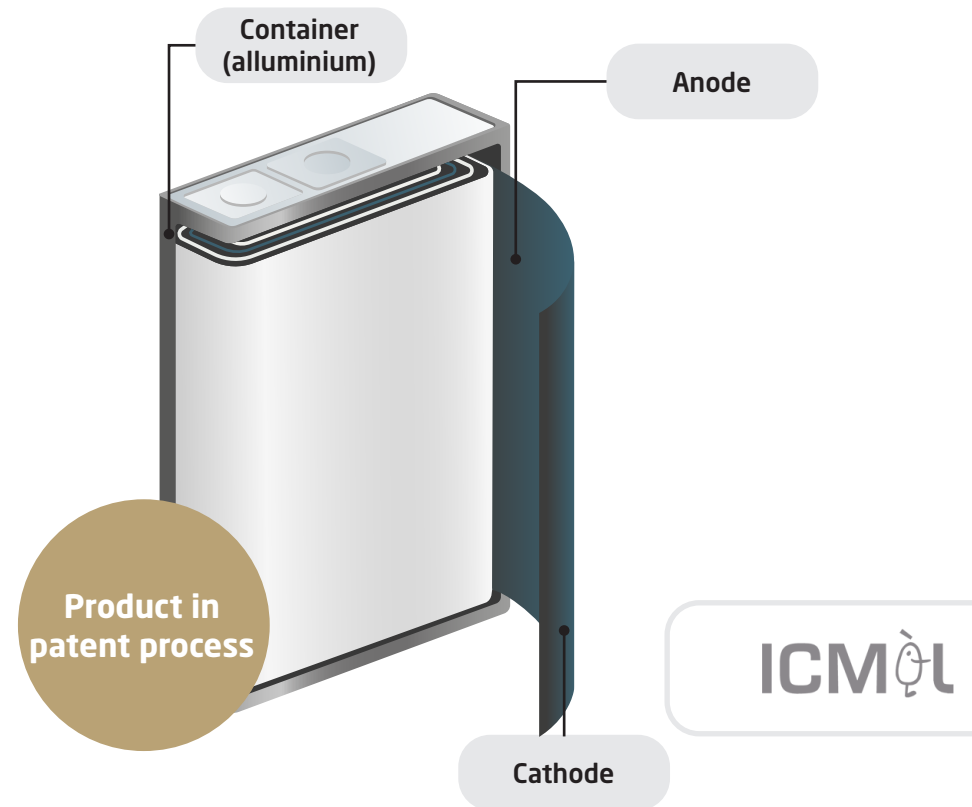
CURRENT SYSTEM

GRAPHENANO SYSTEM

Components of a lithium-ion (li-ion) battery

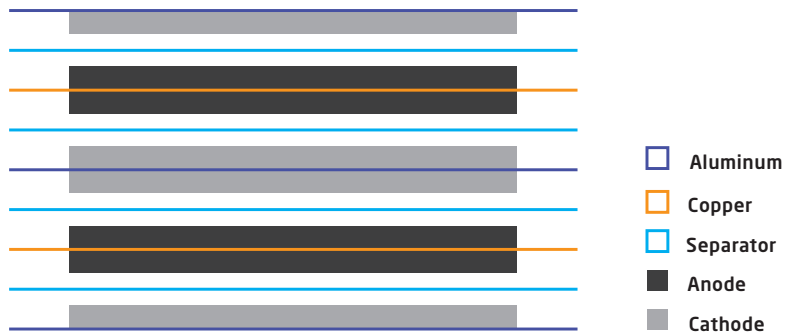


Components of a Graphenano battery



CURRENT SYSTEM

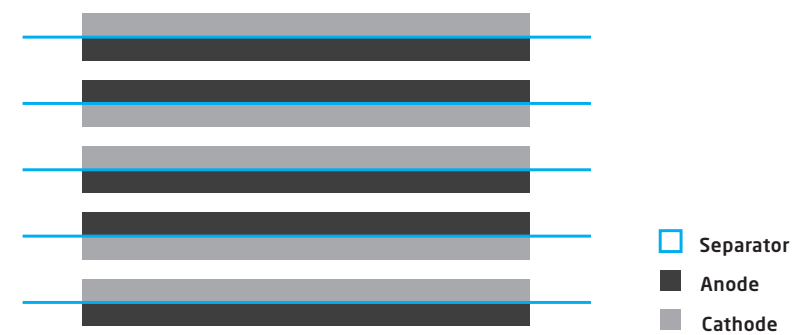
Components of a (li-ion) battery



2 Copper sheets (Cu)
4 Anode sheets
4 Cathode sheets
4 Separator sheets
3 Aluminum sheets

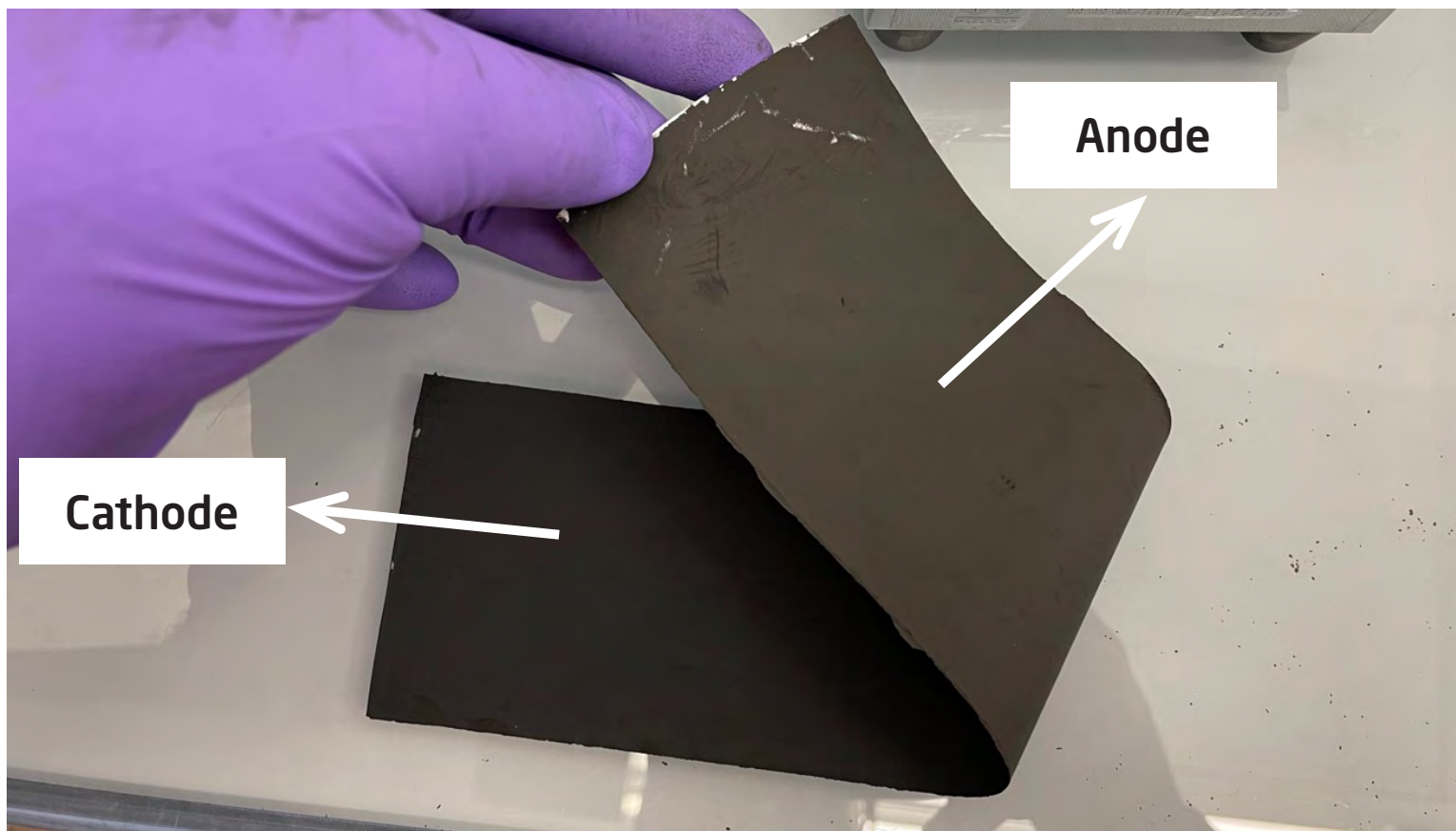
GRAPHENANO SYSTEM

Components of a Graphenano battery



0 Copper sheets (Cu)
5 Anode Sheets
5 Cathode sheets
5 Separator Sheets
0 Aluminum sheets

GRAPHENANO SYSTEM



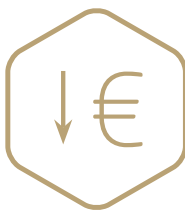


COMPETITIVE ADVANTAGES



WEIGHT REDUCTION POUCH = INCREASE DENSITY 30%

- The elimination of the collectors for the cathode and anode reduces weight considerably, increasing the density proportionally.



COST REDUCTION

- Fewer material, less weight, more density = direct product cost reduction due to the materials employed.



MUCH MORE ECO-FRIENDLY AND SAFE

- **NO FIRE**
- **NO EXPLOSION**
- By renouncing the commonly used metals such as copper and aluminium, it is much more eco-friendly.
- It improves thermal conductivity which helps to be safer and more efficient.



LESS COMPLEX PRODUCTS

- It simplifies and increases the productive capacity of the electrodes, making it possible to use higher depositing speeds.
- Anode and cathode drying energy reduction.
- Simplified anode and cathode manufacturing machinery and processes.



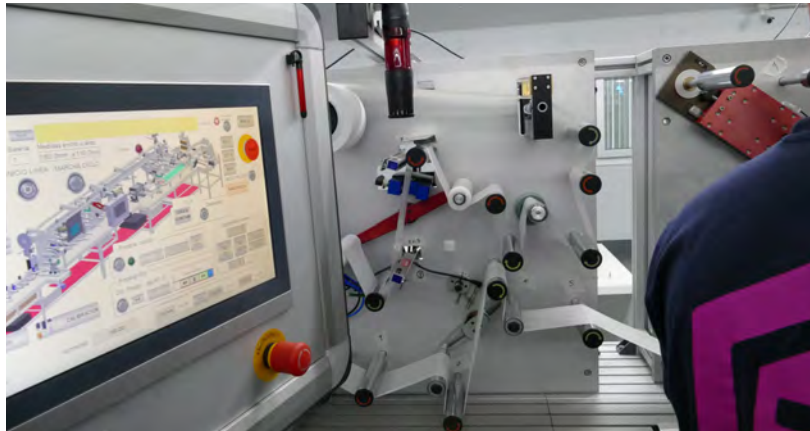
FACILITIES & RESOURCES



FACILITIES & RESOURCES



FACILITIES & RESOURCES





LINES IN RESEARCH AND DEVELOPMENT

GRAPHENE-BASED REFRIGERANT LIQUIDS

IMPROVEMENTS IN REFRIGERATION AND THERMAL CONDUCTIVITY

- Improvement of 20% in ethylene glycol/water mixtures.
- Improvement of 26% on ethylene glycol.
- Improvement of 17% in glycerol-based refrigerant liquids.

Development of thermal pastes, films, and other refrigerant liquids.

Thanks to our **Heat Transfer Fluid with Graphene**, we achieve more efficient refrigeration and thermal conductivity than with conventional heat transfer fluid, improving thermal performance.

Heat Transfer Fluid with Graphene can be used in different sectors, such as:



Automotive

Reduction of about 40% of the radiator surface area (refrigeration system).



Industry

Energy savings in heating and refrigeration processes, doubling the current energy efficiency.



Conditioning

A geothermal-based energy system could be optimised, doubling its performance. This optimisation can be carried out in any system that uses thermal fluids.

ADDITIVE FOR MANUFACTURE OF GLASS CONTAINERS

- Improved friction scratching in forced ageing tests, with improvement values of around 10-15% in preliminary studies.
- Currently in the process of certification for use in food packaging (ITENE)
- Pending Certification.



ADDITIVE FOR ADVANCED TEXTILES

- Improvement of thermal conductivity and mechanical properties of textiles.
- Improved electrical conductivities for smart textiles.

Research phase.



ELECTROSPINNING

- Membranes for making 6 micron battery separators (the world's thinnest development)
- Process for the creation of materials.
- Manufacture of membranes and filters.
- Non-woven fabrics with electrical and thermal performance.
- Coatings for cosmetics, energy storage, among other applications.



HYPERCAP

- Improved faradic capacity compared to commercially available materials. Fast loading/density
- Raw materials not geolocalised and abundant in nature
- Materials 100% recyclable
- WATER based GREEN technology
- Possibility of water-based electrode

- DEVELOPMENT PHASE -

Research into other technologies with higher energy densities. Experimental phase

Other R+D lines

+ **Hydrogen Cell:** Graphene membranes for much more efficient electrolysis and hydrogen generation, replacing platinum catalysts. Improved density and durability of hydrogen cells at room temperature.

+ **Nanochips:** New generation of chips developed with mono-crystalline atomic graphene 100 times smaller than current 2 nanometre chips. Much more processing power than current chips, lower manufacturing costs.



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Ramón y Cajal Abogados



Graphenano Nanotechnologies
info@graphenano.com

Calle Pablo Casals, 13.
30510 · Yecla, Murcia (Spain)
t. (+34) 965 108 102

www.graphenano.com

