

GANF Carbon Nanofibers

Grupo Antolin

www.grupoantolin.com/en



MATERIAL FEATURES AND COMPOSITION

Stacked graphene layers.

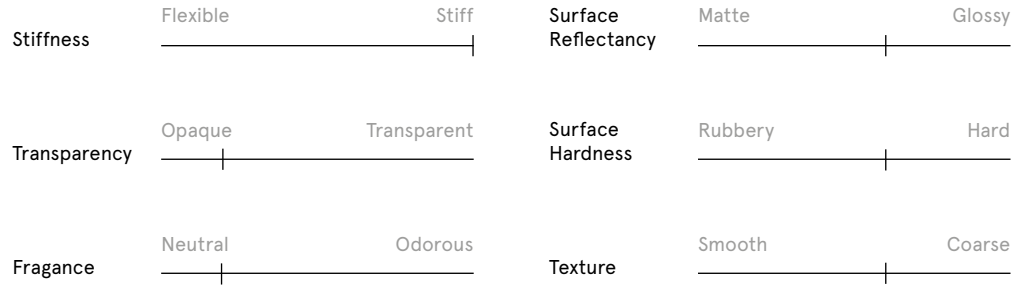
AVAILABILITY

TRL 9 - Actual system proven in operational environment
Commercially available in large amount

A decorative bar chart at the bottom of the page, consisting of several vertical bars of increasing height from left to right, rendered in a light gray color.

TRL9

PHYSICAL QUALITIES



SUSTAINABILITY PROPERTIES*

| | | | | | |
|------------------|----------------|---------------|-----------------------------|-------------------|------------------------------|
| | | | | | |
| Biodegradability | Compostability | Recyclability | Recycled Pre-Consumer Waste | Renewable Content | Recycled Post-Consumer Waste |

PERFORMANCE PROPERTIES

SMART PROPERTIES*

| | | | | | | | | | |
|-----------------------|----------------------|-----------------|-------------------|--------------------|--------------------|--------------------|---------------|-----------------------------|----------------|
| | | | | | | | | | |
| Acoustic Conductivity | Chemical Resistance | Fire Resistance | Impact Resistance | Scratch Resistance | Electrorheological | Magnetorheological | Piezoelectric | Phase Change Material (Pcm) | Photocatalytic |
| | | | | | | | | | |
| Stain Resistance | Thermal Conductivity | UV Resistance | Water Resistance | Wear Resistance | Photochromic | Photoluminescent | Shape Memory | Thermochromic | Thermoelectric |

UNDERSTANDING

*Please see the Glossary at the end of this booklet for more explanation on the terminology.

CERTIFICATES & TESTS

GREENGUARD® Certified for Indoor Air Quality (IAQ).
All information has been provided by the companies and/or material suppliers that delivered the EM&Ts samples.

SUPPLY

Raw Material

Processed Material

System / Product

SHAPE



Powder

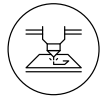
MANUFACTURING PROCESSES

Submicron carbon fibers grown in vapor phase.

TRANSFORMATION PROCESSES



Additive
Manufacturing



Die Cutting



Lamination



Textile
Processing



Blow Molding



Extrusion



Metal Working Tools



Thermoforming
Compression Molding



Casting



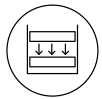
Injection Molding



Printing



Welding



Cold Pressing /
Deep Drawing



Lab Growing



Rotomolding



Wood Working Tools



SHAPING

APPLICATION FIELDS

Carbon nanofibers are converted into clients' solutions and graphene related products such as coatings with improved functional and mechanical properties, batteries, supercapacitors in such areas as automotive, sports gear, electronics, wind energy.



CASE STUDY

Yarara Edition 2019 manufactured by Vibor-a Padel S.L. The graphenic materials of Grupo Antolin are produced from their carbon nanofibers GANF which are converted into clients' solutions and graphene related products in various material brands ready to use in their processes.

COMPARISON & INNOVATION

Similar to other carbon nanofibers with an excellent quality. Its high aspect ratio and a high graphitic structure confers GANF material excellent mechanical properties as well as electric and thermic conductivity.



APPLYING

SUSTAINABILITY PROPERTIES

Biodegradability

Ability to be broken down into carbon dioxide, water, and biomass by the natural action of microorganisms (aerobic and/or anaerobic). It is misleading to merely claim biodegradability without any standard specification. If a material or product is advertised to be biodegradable, further information about the timeframe, the level of biodegradation, and the required surrounding conditions should be provided, too.

Composting

Ability to go through the process by which materials biodegrade through the action of naturally occurring microorganisms and do so to a large extent within a specified timeframe. The associated biological processes will yield CO₂, water, inorganic compounds, and biomass which leaves no visible contaminants or toxic residues. The products can be classified in "Home compostable" or "Industrial compostable", having each of them specific temperatures, conditions and timeframes defined by international regulations.

Recyclability

The capacity of a product to be reduced all the way back to its basic materials, reprocessing those materials, and using them to make new products, components or materials. Recycling refers to materials that are processed in practice (as opposed to materials for which recycling is technically feasible), this varies from one region to the other invoking the regulations and technologies of each country.

Recycled pre-consumer waste

Pre-consumer waste refers to waste produced by manufacturers or industries before released for consumer use. Pre-consumer waste refers also to the reintroduction of manufacturing discards back into the manufacturing process, in this case it is often not considered "recycling" in the traditional sense. Pre-consumer waste is produced in large quantities, while this is easier to collect and sort, high amounts of pre-consumer waste are non-recovered.

Renewable content

Materials that are replenished at a rate equal to or greater than the rate of depletion and must be produced using regenerative practices or, in a transition phase, using sustainable practices.

Recycled post-consumer waste

Post-consumer waste is the waste produced at the end of a consumer-product lifecycle. Post-consumer waste has served its intended purpose, passed through the hands of a final consumer, and has been discarded for disposal or recovery. It usually refers to the household waste we generate every day, and does not include manufacturing or converting wastes. Depending on the type of waste, governmental legislation and the action taken by the consumer, post-consumer waste is recycled, sent to landfill or incinerated.

SMART PROPERTIES

Electrorheological

Change in the rheological properties (viscosity and viscoelasticity) of a material caused by an electrical stimulus.

Magnetorheological

Change in rheological properties (viscosity and viscoelasticity) of a material caused by a magnetic field.

Piezoelectric

Phenomenon exhibited by certain materials, which when applying mechanical stress, generate electrical energy. The effect can also be inverse, that is, they can present small deformations when an electrical current is applied.

Phase Change Material (PCM)

Materials considered latent heat storage units: They are capable of absorbing or releasing a large amount of thermal energy when they undergo a phase change (from solid to liquid, from liquid to gas, or vice versa).

GLOSSARY

Photocatalytic

A substance that increases the speed of a chemical reaction by the effect of light or other forms of radiant energy.

Photochromic

Reversible color change induced by the indication of sunlight or UV. The color disappears when the fountain ceases.

Photoluminiscent

Is the emission of cold light caused by the absorption of electromagnetic radiation (visible light, UV, X and cathode rays). There are two types of luminescence: fluorescence (emits light only during absorption of radiation) and phosphorescence (stores absorbed radiation, so that it continues to emit light for a time after the stimulus subsides).

Shape Memory

The material with this property recovers its initial shape after being permanently deformed (plastically) when heated above a characteristic transition temperature of the material. In addition, while regaining its form, in some cases it is able to perform work. The characteristics of these materials, depending on the temperature, contemplate superelasticity (which grants large elastic deformations in a specific range of temperatures), simple shape memory effect (in which the material

remembers a single shape, when heated) and which can be educated to achieve a double shape memory effect (in which the material memorises two shapes in a hot and cold state).

Thermochromic

Reversible or irreversible color change induced by temperature changes.

Thermoelectric

Property that supposes a change of voltage in response to a variation of temperature and vice versa.

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NANOMATERIALS EM&TS

Entirely carbon-based materials, nano-scaled structures or composite blends whose properties are altered by surface and/or substrate doping thereof. NANO TECH: Matter controlled at molecular level, which is smaller than a micrometres, normally on scales of 1 to 100 nanometres.

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