

Environmental Product Declaration



In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

GRAPHENE MASTER BASE

Graphene-based material dispersion



From **Graphenano Smart Materials S.L.**

Programme:	The International EPD® System, www.environdec.com
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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com



General information

Programme information

Programme:	The International EPD® System
Address:	EPD International AB Box 210 60 SE-100 31 Stockholm Sweden
Website:	www.environdec.com
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CEN standard EN 15804 serves as the Core Product Category Rules (PCR)
Product category rules (PCR): PCR 2019:14 Construction products (EN 15804:A2) Version 1.2.5
PCR review was conducted by: PCR review was conducted by: The Technical Committee of the International EPD®System. See www.environdec.com/TC for a list of members. Review chair: Claudia A. Peña, University of Concepción, Chile. The review panel may be contacted via the Secretariat www.environdec.com/contact .
Independent third-party verification of the declaration and data, according to ISO 14025:2006: <input checked="" type="checkbox"/> External <input type="checkbox"/> Internal Covering <input type="checkbox"/> EPD process certification <input checked="" type="checkbox"/> EPD verification
Third party verifier: Marcel Gómez, Marcel Gómez Consultoría Ambiental Accredited by: The International EPD® System
Procedure for follow-up of data during EPD validity involves third party verifier: <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with EN 15804, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see EN 15804 and ISO 14025.

Company information

Owner of the EPD: **GRAPHENANO SMART MATERIALS S.L**

Description of the organisation:

Graphenano Smart Materials was founded in 2015 as a subsidiary of Graphenano Group, involved in the development and application of graphene admixtures for advanced construction materials which greatly improve the mechanical performance, durability and resistance to external attacks, as well as the performance of the necessary raw materials.

Graphenano Smart Materials is a global pioneer in the manufacture of admixtures with graphene technology for advanced high performance, ecological building materials, such as high-performance and environmentally friendly special concretes and cements. Thanks to Graphenano's graphene, products improve the mechanical performance, quality and performance of conventional building materials.

Name and location of production site(s):

HORMINANO, S.L. C/ PABLO CASALS, 13
30510 – YECLA- MURCIA (Spain)
<https://www.graphenanosmartmaterials.com>

Contact:

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Product information

Product name: Graphene Master Base.

Product description: Water-based dispersion of graphene-based material for the development of admixtures and products for construction. 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. This technology provides improvements in mechanical performance, durable performance and maximum efficiency in its products.

Graphene is a bidimensional material formed by carbon atoms attached each other into sp^2 bonds, creating a characteristic honeycomb structure. Graphene-based materials are products which have similar structure than graphene. This similarities in the structure leads to characteristics and properties very close to those of pristine graphene and can therefore be used as substitutes to it. These materials can exhibit very good mechanical characteristics, as well as electrical, thermal and even antibacterial properties. It is the mechanical properties that improve the mechanical performance, quality and performance of admixtures and products for construction.



Example of product made from the products analysed

The technical characteristics of the product are the following:

CHARACTERISTIC			
Aspect:	Black liquid with solid material in suspension		
pH, 20 °C	7.74 ± 0.52		
Conductivity (µS)	143.57 ± 22.78	Min. *	39.0
Viscosity 20 °C	< 20 cps.		
Dry residue (%)	5.48 ± 0.89		

UN CPC code: CPC 35499: Other chemical products.

LCA information

Declared unit: The declared unit is the baseline reference for which all information is collected. In this study, the declared unit is “**1 kg of Graphene Master Base**”.

Reference service life: Not relevant for this EPD.

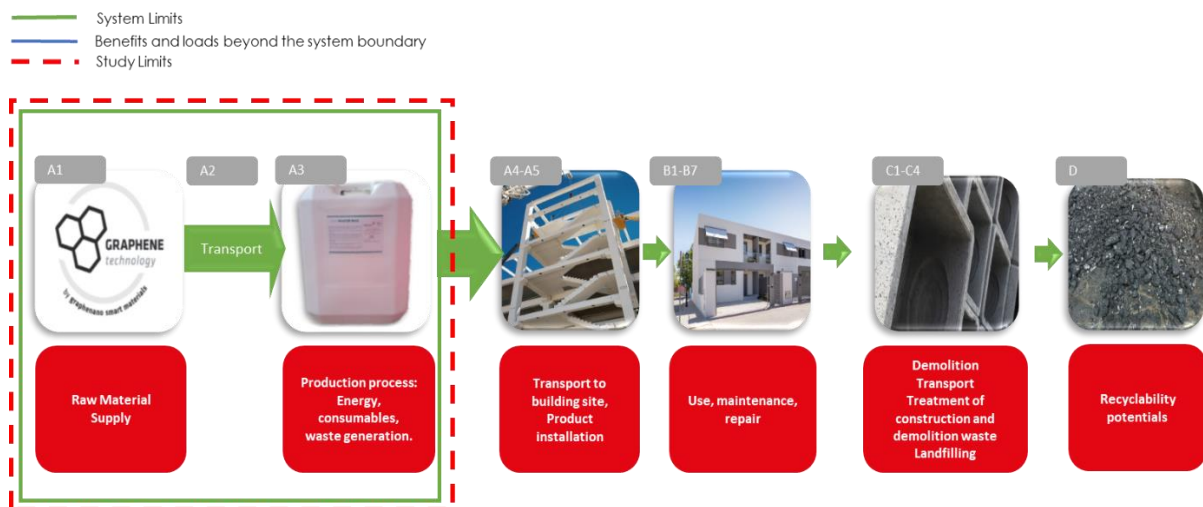
Geographical scope: The geographical scope of this EPD is global.

Time representativeness: The data collection from factory (primary data) and electricity mix are from 2021/01/01 to 2021/12/31. In this study, no datasets older than 10 years were used.

Database(s) and LCA software used: All the data used to model the process and obtain the Life Cycle Inventory are specific data and have been obtained by measurements made during the period from 2021/01/01 to 2021/12/31. They are representative of the different processes implemented during the manufacturing process. The data has been measured directly at the company's own premises. In addition, the most complete and highest quality European life cycle inventory database, Ecoinvent 3.8, has been used, as this database contains the most extensive and updated information and its scope coincides with the geographical, technological and temporal area of the project. The LCA was modelled with Simapro 9.3.0.3.

Description of system boundaries: According to the standard UNE-EN 15804_2012+A2_2020 (MARCH 2020) and PCR 2019:14 CONSTRUCTION PRODUCTS (version 1.2.5) the system boundary is cradle to gate (A1–A3). The optional life cycle stages A4-A5, B1-B7 are not included in this LCA study. In addition, all exception criteria are met, so the life cycle stages C1-C4 and D were excluded from the LCA study.

System diagram:



Manufacturing process:

Graphene Master Base is manufactured by mixing graphene-based material with other ingredients in batch mode. This mixture involves different physical dispersion processes, when the graphene materials are dispersed in the liquid matrix of the products. They are packed in reused plastic packaging.

Author of the Life Cycle Assessment:

IK ingeniería

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48970 Basauri, Bizkaia (Spain)

Data quality

The environmental impact of the Graphene Master Base has been calculated. It is based on the international standards established for the development of environmental product declarations, such as ISO 14025 for the preparation of the environmental product declaration, ISO 14040 and ISO 14044 for the preparation of the life cycle analysis, UNE-EN 15804:2012+A2:2020 (MARCH 2020) and the Product Category Rules PCR - "2019:14 Construction products " (Version 1.2.5).

Data has been collected from 2021/01/01 to 2021/01/31 and is representative of that year. Data for raw material supply, transport to fabrication plant and production (A1-A3) is based on specific consumption data for the factory at Yecla. Generic background datasets were used for the downstream processes. SimaPro v9.3.0.3. software was used to prepare the life cycle analysis together with the Ecoinvent 3.8 database. Characterization factors from EN15804: 2012 + A2:2019. The geographical coverage is global. Technological coverage is typical or average.

Assumptions

The modularity principle, as well as the polluter-payer principle have been followed. The following assumptions have been made in this EPD:

- ✓ It does not include the manufacturing processes of the capital goods or spare parts and/or maintenance with a life of more than three years.
- ✓ The environmental impact of infrastructure for general management, office, and headquarters operations is not included.
- ✓ Long term emission excluded.
- ✓ The impact caused by people (common activities, travel for work...) will not be considered.
- ✓ It does not include the consumption of natural gas for sanitary hot water from showers and heating system for the comfort of people.
- ✓ The processes associated with fuel production are intrinsically included in the indicators in ECOINVENT's database used in carrying out the LCA.
- ✓ The environmental impact of external transport has been calculated using lorries from the ECOINVENT 3.8 database, EURO 5. These lorries have been selected to reflect the most realistic scenario possible.
- ✓ It follows the three criteria defined by the EN15804 standard that enables "Cradle to gate" EPDs.

Cut-off rules

The standard ISO 14025 and the PCR -"2019:14 CONSTRUCTION PRODUCTS" indicate that the life cycle inventory data should include a minimum of 95% of the total inputs (materials and energy) for each stage. This cut-off rule does not apply for hazardous materials and substances. No such cut-off criteria have been taken into account in this study.

Allocation

Where necessary, such as waste generation and energy consumption, an allocation based in mass has been used.

Greenhouse gas emission from the use of electricity in the manufacturing phase

Specific electricity mix, medium voltage (direct emissions and losses in grid) 100% renewable electricity is considered for the manufacturing process.

Electricity mix	Amount	Units
Specific electricity mix	5,02E-02	Kg CO2-eqv/kWh

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation:

	Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	EU	EU	EU	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Specific data	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	0%			-	-	-	-	-	-	-	-	-	-	-	-	-	-

ND: Not declared

Content information

Product components	Per 1 kg		
	Weight, kg	Post-consumer material, weight-%	Renewable material, weight-%
Water base	9,47E-01	0,00%	0,00%
Additives	5,25E-02	0,00%	0,00%
TOTAL	1,00E+00	0,00%	0,00%
Packaging materials	Weight, kg	Weight-% (versus the product)	
Wood	4,73E-02	4,73%	
Plastic	5,70E-02	5,70%	
Labels	9,96E-05	0,01%	
TOTAL	1,04E-01	10,44%	

Packaging: The product is transported to the costumers in plastic packaging.

No substances included in the Candidate List of Substances of Very High Concern for authorization under REACH Regulations are present in the concrete admixture manufactured by Graphenano Smart Materials, either above the threshold for registration with the European Chemicals Agency or above 0,1% (wt/wt).

Environmental Information

Life cycle impact assessment results are relative expressions and do not predict final impacts by category, threshold exceedances, safety margins or risks.

Potential environmental impact – mandatory indicators according to EN 15804:

Results per declared unit		
Indicator	Unit	A1-A3
GWP-fossil	kg CO ₂ eq.	2,69E+00
GWP-biogenic	kg CO ₂ eq.	-6,05E-02
GWP-luluc	kg CO ₂ eq.	3,51E-03
GWP-total	kg CO ₂ eq.	2,63E+00
ODP	kg CFC 11 eq.	5,11E-08
AP	mol H ⁺ eq.	4,48E-03
EP-freshwater	kg PO ₄ ³⁻ eq.	4,21E-05
EP-freshwater	kg P eq.	1,37E-05
EP-marine	kg N eq.	8,17E-04
EP-terrestrial	mol N eq.	9,11E-03
POCP	kg NMVOC eq.	4,13E-03
ADP-minerals&metals*	kg Sb eq.	5,01E-06
ADP-fossil*	MJ	4,59E+01
WDP	m ³ deprive	7,24E-01
Acronyms	GWP-fossil = Global Warming Potential fossil fuels; GWP-biogenic = Global Warming Potential biogenic; GWP-luluc = Global Warming Potential land use and land use change; ODP = Depletion potential of the stratospheric ozone layer; AP = Acidification potential, Accumulated Exceedance; EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment; EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment; EP-terrestrial = Eutrophication potential, Accumulated Exceedance; POCP = Formation potential of tropospheric ozone; ADP-minerals&metals = Abiotic depletion potential for non-fossil resources; ADP-fossil = Abiotic depletion for fossil resources potential; WDP = Water (user) deprivation potential, deprivation-weighted water consumption	

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

Potential environmental impact – additional mandatory and voluntary indicators

Results per declared unit		
Indicator	Unit	A1-A3
GWP-GHG ¹	kg CO ₂ eq.	2,54E+00

Use of resources

Results per declared unit		
Indicator	Unit	A1-A3
PERE	MJ	4,50E+00
PERM	MJ	9,14E-01
PERT	MJ	5,42E+00
PENRE	MJ	4,33E+01
PENRM	MJ.	2,63E+00
PENRT	MJ	4,59E+01
SM	kg	0,00E+00
RSF	MJ	0,00E+00
NRSF	MJ	0,00E+00
FW	m ³	1,50E-02
Acronyms	PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials; PERM = Use of renewable primary energy resources used as raw materials; PERT = Total use of renewable primary energy resources; PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials; PENRM = Use of non-renewable primary energy resources used as raw materials; PENRT = Total use of non-renewable primary energy re-sources; SM = Use of secondary material; RSF = Use of renewable secondary fuels; NRSF = Use of non-renewable secondary fuels; FW = Use of net fresh water	

¹ The indicator includes all greenhouse gases included in GWP-total but excludes biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. This indicator is thus equal to the GWP indicator originally defined in EN 15804:2012+A1:2013.

Waste production

Results per declared unit		
Indicator	Unit	A1-A3
Hazardous waste disposed	kg	1,38E-05
Non-hazardous waste disposed	kg	7,27E-02
Radioactive waste disposed	kg	3,41E-05

Output flows

Results per declared unit		
Indicator	Unit	A1-A3
Components for re-use	kg	0,00E+00
Material for recycling	kg	4,79E-04
Materials for energy recovery	kg	0,00E+00
Exported energy, electricity	MJ	0,00E+00
Exported energy, thermal	MJ	0,00E+00

Information on biogenic carbon content

Results per declared unit		
BIOGENIC CARBON CONTENT	Unit	QUANTITY
Biogenic carbon content in product	kg C	0,00E+00
Biogenic carbon content in packaging	kg C	0,00E+00

Note: 1 kg biogenic carbon is equivalent to 44/12 kg CO₂.

The product does not contain biogenic carbon and the mass of biogenic carbon-containing materials in the packaging is less than 5% of the total mass of the product, therefore the declaration of biogenic carbon content can be omitted.

Additional information

The technical datasheet and the safety datasheet can be found in the following webpage:

<https://www.graphenanosmartmaterials.com/en/inicio/>

Information related to Sector EPD

This is an individual EPD®.

Differences versus previous versions

This is the first version of the EPD®.

References

- General Programme Instruction of the International EPD®System. Version 4.0.
- ISO 14020:2000 Environmental labels and declarations-General principles.
- ISO 14025:2010 Environmental labels and declarations-Type III Environmental Declarations-Principles and procedures.
- ISO 14040:2006 Environmental Management-Life Cycle Assessment-Principles and framework.
- ISO 14044:2006 Environmental Management-Life Cycle Assessment-Requirements and guidelines.
- PCR 2019:14 Construction products (EN 15804: A2) version 1.2.5
- EN 15804:2012+A2:2019 Sustainability of construction works-Environmental Product Declarations-Core rules for the product category of construction products
- LCA report GRAPHENE MASTER BASE, PRECAST GRAPHENE FLUID G100 and PRECAST GRAPHENE FLUID ULTRA V.1.0 (23 December 2023).

