

SECTION 1: Identification of the substance/mixture and of the company/undertaking**1.1. Product identifier**

| | |
|----------------------------------|---|
| Product name: | CVD graphene film on Cu substrate |
| Other names: | Graphenea-Monolayer graphene made via CVD |
| CAS # | Not applicable (mixture) |
| EC # | Not applicable (mixture) |
| Index N° | Not applicable (mixture) |
| REACH Registration number | Not applicable (see section 3) |
| CLP C&L inventory | Not applicable (mixture) |

1.2. Relevant identified uses of the substance or mixture and uses advised against

| |
|------------------------------|
| Identified uses: |
| Industrial use |
| Uses advised against: |
| None identified |

1.3. Details of the supplier of the safety data sheet

Graphenea S.A.
Tolosa Hiribidea 76
20018 Donostia-San Sebastian (Spain)
Phone: +34 943 359 876
Email for SDS: info@graphenea.com

1.4. Emergency telephone number

+34 943 359 876 (business hours, Central European Time - CET)

SECTION 2: Hazards identification**2.1. Classification of the substance or mixture**

Not classified as a hazardous mixture according to CLP (Regulation EC 1272/2008) / GHS (rev. 5).

2.2. Label elements

No label required

2.3. Other hazards

Physical Hazards: graphene is electrically conductive. Care should be taken, therefore, to avoid accumulations of graphite dusts or powders in places where these accumulations could cause shorting of electrical switches, circuits or components.

SECTION 3: Composition/information on ingredients

3.2. Mixtures

| | |
|--------------------|--|
| Description | Graphene film on Cu substrate. Graphene (CAS 1034343-98-0) is a thin layer of pure carbon; it is a single, tightly packed layer of carbon atoms that are bonded together in a hexagonal honeycomb lattice. It is an allotrope of carbon in the structure of a plane of sp ² bonded atoms with a molecule bond length of 0.142 nanometres. Layers of graphene stacked on top of each other form graphite, with an interplanar spacing of 0.335 nanometres. |
|--------------------|--|

| Name | CAS | EC | N° REACH | Classification (CLP) |
|-----------------------|--------------|------------------------------|----------|----------------------|
| Graphene | 1034343-98-0 | 231-955-3 (graphite bulk) | N/A* | Not classified** |
| Copper (substrate) | 7440-50-8 | 231-159-6 | N/A* | Not classified |

* Annual tonnage does not require registration or the registration is envisaged for a later registration deadline.

** Please notice that substance properties used for the hazard assessment of the mixture come from graphite (bulk substance, CAS 7782-42-5). The properties of the nanoform are under evaluation and to some extent not known.

SECTION 4: First aid measures

4.1. Description of first aid measures

| | |
|---------------------|---|
| Inhalation | In case of discomfort provide fresh air, warmth and rest, preferably in a comfortable upright sitting position. Rinse nose and mouth with water. Get medical attention if any discomfort continues. If breathing stops, provide artificial respiration. |
| Ingestion | NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! Rinse nose, mouth and throat with water, and then drink plenty of water. Get medical attention. |
| Skin contact | Wash skin with soap and water. Continue to rinse for at least 15 minutes. Get medical attention if irritation appears after washing. |
| Eye contact | Do not rub eye. Immediately flush with plenty of water for up to 15-20 minutes. Remove any contact lenses after 5 minutes, maintain open eyes wide apart. Get medical attention promptly if symptoms occur after washing. |

4.2. Most important symptoms and effects, both acute and delayed

| | |
|-------------------|---|
| Inhalation | It may cause irritation to respiratory tract/inhalation |
|-------------------|---|

| | |
|------------------------|-------------------------------|
| Ingestion | No effects recorded |
| Skin contact | It may cause skin irritation. |
| Eye contact | It may cause eye irritation. |
| Delayed effects | No delayed effects known. |

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically. Contact a poison centre immediately in case of ingestion or inhalation of a large amount of product. Specific treatment: No specific treatment.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media: The mixture is not combustible, use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2. Special hazards arising from the substance or mixture

In the event of combustion or thermal decomposition, this material may release carbon monoxide (CO) or carbon dioxide (CO₂) or other toxic gases.

5.3. Advice for firefighters

In general, this product is difficult to combust. Normal care should be taken to avoid dust explosion risk caused by high concentrations of dust or finely suspended airborne particles. Use respiratory protective equipment.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

Emergency responders should wear suitable protective equipment to prevent inhalation or skin contact. In case of spills, beware of slippery floors and surfaces.

6.2. Environmental precautions

Do not allow to enter drains, sewers or watercourses. The product should not be dumped in nature but collected and delivered according to local regulations.

6.3. Methods and material for containment and cleaning up

Spilled or released material should be collected mechanically and disposed of in suitable containers. Prevent dust generation.

6.4. Reference to other sections

For personal protection, see section 8.
For waste disposal, see section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Good laboratory practices should always be used. Avoid contact with skin and eyes. Wear personal protective equipment to prevent skin and eye contact. Do not wear contact lenses when using this product. Avoid inhalation using local ventilation or appropriate filters.

7.2. Conditions for safe storage, including any incompatibilities

Store in cool, dry place in tightly closed containers. No special precautions needed.

7.3. Specific end use(s)

Industrial use.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

| Substance: Graphite (CAS 7782-42-5) | | | | |
|-------------------------------------|---------------------------|------------------------|--------------------------|----------------------|
| | Limit value - Eight hours | | Limit value - Short term | |
| | ppm | mg/m ³ | ppm | mg/m ³ |
| Australia | | 3 (1)(2)(3)(4) | | |
| Belgium | | 2 | | |
| Canada - Ontario | | 2 (1) | | |
| Canada - Québec | | 2 | | |
| Denmark | | 2,5 respirable aerosol | | 5 respirable aerosol |
| Finland | | 2 | | |

| | | | |
|----------------------------|---|--|--|
| France | 2 respirable aerosol | | |
| Germany (DFG) | 4 inhalable aerosol 1,5 respirable aerosol | | |
| Ireland | 10 (1) 4 (2) | | |
| Latvia | 2 (1) | | |
| New Zealand | 3 (1)(2) | | |
| People's Republic of China | 4 (1) | | |
| | 2 (2) | | |
| Singapore | 2 respirable aerosol | | |
| South Korea | 2 (1)(2) | | |
| Spain | 2 inhalable aerosol | | |
| Sweden | 5 inhalable aerosol | | |
| Switzerland | 5 inhalable aerosol | | |
| USA - NIOSH | 2,5 respirable aerosol 2,5 (1) | | |
| USA - OSHA | 15 total dust 5 respirable dust | | |
| United Kingdom | 10 inhalable aerosol 4 respirable aerosol | | |

| Remarks | |
|----------------------------|--|
| Australia | (1) all forms except fibres (2) respirable aerosol (3) natural and synthetic (4) containing no asbestos and<="" td=""> |
| Canada - Ontario | (1) Respirable aerosol |
| Ireland | (1) Inhalable fraction (2) Respirable fraction |
| Latvia | (1) natural and industrial diamond, graphite |
| New Zealand | (1) Respirable dust containing <1 % free silica (2) all form except graphite fibres |
| People's Republic of China | (1) Inhalable fraction (2) Respirable fraction |
| South Korea | (1) Natural & synthetic except graphite fibers (2) Respirable fraction |
| USA - NIOSH | (1) natural graphite |

8.2. Exposure controls

Protective equipment



Engineering measures

Provide adequate ventilation. Observe Occupational Exposure Limits and minimise the risk of inhalation. Provide eyewash station.

| Personal Protective Equipment | |
|---|---|
| Respiratory equipment | Respiratory protection must be used if the general level exceeds the recommended occupational exposure limit. A respiratory protection program that meets applicable OSHA (USA) or CEN (UE) requirements should be maintained in the workplace. |
| Hand protection | Wear protective gloves. |
| Eye protection | Wear approved safety goggles. Use face shield in case of splash risk. |
| Body protection | Wear full body industrial type work clothing. |
| Environmental exposure controls | |
| All ventilation systems should be filtered before discharge to atmosphere. Avoid releasing to the environment. Avoid uncontrolled releases. Inform competent authorities in case large spillage into water courses. | |

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

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|---|--|
| Appearance | One atom thick film on Cu (18 µm). |
| Colour | Colourless. |
| Odour | Odourless. |
| Initial boiling point and boiling range (°C) | Cu (18 µm) 2562 °C; Graphene not applicable.. |
| Melting point (°C) | Cu (18 µm) 1084 °C ; Graphene approx. 3600°C. |
| Vapour density (air=1) | Not applicable. |
| Vapour pressure | Not applicable. |
| Evaporation rate | Not applicable. |
| pH-Value, Conc. Solution | Not applicable. |
| Viscosity 40°C | Not applicable. |
| Bulk density (20°C) | Cu (18 µm) 8.640 g/cm ³ ; Graphene 2.09–2.23 g/cm ³ . |
| Solubility Value | Insoluble. |
| Decomposition temperature (°C) | - |
| Flash point (°C) | Not applicable. |
| Auto Ignition Temperature (°C) | Not available. |
| Oxidising properties | Not applicable (the mixture is incapable of reacting exothermically with combustible materials on the basis of chemical structure)). |

9.2. Other information

No information required.

SECTION 10: Stability and reactivity

10.1. Reactivity

There are no known reactivity hazards associated with this product.

10.2. Chemical stability

Stable under normal temperature conditions.

10.3. Possibility of hazardous reactions

Not known.

10.4. Conditions to avoid

Not known.

10.5. Incompatible materials

Avoid contact with strong oxidizing agents, fluorine, or chlorine trifluoride.

10.6. Hazardous decomposition products

Under fire conditions, this material may release carbon monoxide (CO) or carbon dioxide (CO₂) or other toxic gases.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Absorption, distribution, metabolism

| | |
|---|-------------------|
| Absorption | No data available |
| Distribution | No data available |
| Potential for accumulation | No data available |
| Toxicologically significant metabolite | No data available |

Acute toxicity

| | |
|----------------------------|-------------------------------|
| Rat LD50 oral | >2 gr/kg; rat (graphite bulk) |
| Rat LD50 dermal | No data available |
| Rat LC50 inhalation | No data available |
| Skin irritation | No data available |
| Eye irritation | No data available |
| Skin sensitization | No data available |

Genotoxicity

No data available

Long term toxicity and Carcinogenicity

No data available

Reproductive toxicity

No data available

SECTION 12: Ecological information**12.1. Toxicity**

To the best of our knowledge, there is no reliable data suggesting that graphene should be considered as an environmental hazard.

12.2. Persistence and degradability

Graphene is not biodegradable.

12.3. Bioaccumulative potential

No data available

12.4. Mobility in soil

No data available

12.5. Results of PBT and vPvB assessment

The PBT and vPvB criteria of annex XIII to the Regulation do not apply to inorganic substances. Graphite and silicon are inorganic substances, and therefore PBT and vPvB assessment is not required.

12.6. Other adverse effects

No information required.

SECTION 13: Disposal considerations**13.1. Waste treatment methods****General information**

When handling waste, consideration should be made to the safety precautions applying to handling of the product. Waste should not be disposed of by release to sewers. Uncleaned packagings: Disposal must be made according to official regulations. European legislation: Directive 2008/98/EC.

| ECW Code | Description |
|----------|-------------|
| - | - |

SECTION 14: Transport information**14.1. UN number**

Not classified as a dangerous good for transport under ADR, RID, US DOT, IMDG, or ICAO/IATA

14.2. UN proper shipping name

No information required.

14.3. Transport hazard class(es)

No information required.

14.4. Packing group

No information required.

14.5. Environmental hazards

No information required.

14.6. Special precautions for user

No information required.

14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

No information required.

SECTION 15: Regulatory information**15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture**

REACH authorisations: Not required.
REACH Restrictions of use: None.
SVHC list: No
Other EU regulations: The product does not deplete the ozone layer. The product is not a persistent organic pollutant.

Please check your national requirements for nanomaterials.

15.2. Chemical safety assessment

No chemical safety assessment has been carried out (substances does not require REACH registration).

SECTION 16: Other information

| | |
|---|---|
| Advice on any training appropriate for workers | To ensure protection of human health and environment, workers must be provided with proper training about how to handle and store chemicals used at work. |
| Revision Date | 25 may 2016 |

| | |
|--|---|
| Substituted version | 1.0 |
| Changes to the previous version | Complete revision to adapt the SDS to Regulations 453/2010 and 830/2015 |
| Abbreviations and acronyms | European Chemicals Agency (ECHA) glossary: http://echa.cdt.europa.eu/ |
| Key literature references | Guidance on compilation of Safety Data Sheet (V. 3.1 November 2015). IFA - Databases on hazardous substance (GESTIS): http://limitvalue.ifa.dguv.de/ |
| Note to the reader | In accordance with Article 31 of the REACH Regulation, this product DOES NOT require a Safety Data Sheet. For this reason and in accordance with the criteria established by ECHA (Guidance on compilation of Safety Data Sheet), it cannot be considered that this document must strictly comply with the provisions of Regulation 2015/830. |

This information is based on our present state of knowledge and our research into available scientific literature as well as information obtained from our vendors. Graphenea S.A. makes no responsibility regarding the accuracy of the scientific literature or any third-party information and, therefore, cannot guarantee any specific material properties. Use of this information shall not establish a legally binding relationship.

The information provided in this SDS must be considered as a starting point for a comprehensive program of health and safety in your company. If further data on the product is required to perform your risk assessment, contact us and we will try to assist as much as possible.