Cambridge Nanosystems

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Material Safety Data Sheet (MSDS)

for CamGraph® Graphene Powder

Material Safety Data Sheet

CAMBRIDGE NANOSYSTEMS

1. Identification of the Substance and Information on the Company

Product Name	Graphene nanoplatelets (GNP).
Synonyms	Graphene, graphene sheets, graphene flakes, graphene powder, few layer graphene, graphite powder.
Use of Substance	Additive in coatings, composites, polymers and electronics. Biotechnology related applications are restricted to research purpose only
Supplier	Cambridge Nanosystems Ltd
Postal Address	17 Mercer's Row, Cambridge, CB5 8HY, UK
Manufacturer	Cambridge Nanosystems Ltd
Postal address	17 Mercer's Row, Cambridge, CB5 8HY, UK

Cambridge Nanosystems

2. Hazards Identification

Emergency Overview	• May form combustible dust-air mixture • May cause eye irritation • May cause respiratory tract irritation

CAUTION: This form of carbon has not yet been fully tested regarding health, safety and environmental effects. There is an evidence to suggest this material may have genotoxicological effects resulting in cancer.

Main Hazards	• Ultrafine carbon powder and dust is electrically conductive and may result in accumulation of electrostatic charges. These charges may cause damages to electrical and electronic components. • Ultrafine carbon powder and dust can cause irritation to eyes and respiratory system.
Potential Health Hazards	Inhalation and skin contact are expected to be the primary routes of occupational exposure to this material. Prolonged or repeated contact may remove oils from the skin and may dry skin and cause irritation, redness, and rash. Direct contact of dust with skin and eyes may cause irritation. Overexposure to dust may cause respiratory tract irritation.
Physical Hazards	• Medical conditions aggravated by exposure: asthma, allergies • Potential environmental effects: May cause adverse long-term effects.

3. Composition and Data on Ingredients

Material:	Natural gas or methane

4. First Aid Measures

After Eye Contact	Immediately rinse (flush) eyes with water for at least 15 min holding the eyelid open. Remove contact lenses. If irritation persists, seek medical attention
After Skin Contact	Wash immediately the exposed area with soap and water, rinsing thoroughly and remove contaminated clothing. Seek medical attention if irritation persists.
After Ingestion	Rinse mouth immediately with water. Seek medical attention.
After Inhalation	Move the exposed person to fresh air. If required provide artificial respiration with oxygen and seek medical attention.

5. Fire Fighting Measures

Fire and Explosive	Auto-Ignition Temperature NE
Properties	Flash Point NE Flammable Limits Upper NE Lower NE
Fire Hazards	Burning produces irritation. May combust to toxic fumes with CO content in oxygen deficient conditions.
After Inhalation	Move the exposed person to fresh air. If required provide artificial respiration with oxygen and seek medical attention.
Extinguishing Media	Use water spray or dry powder or carbon dioxide. Do not allow water runoff to enter sewers or drains.

5. Fire Fighting Measures (continued)

Fire Fighting Instructions	Do NOT use a solid stream of water. A solid stream of water can cause a dust explosion. Fire fighters and others who may be exposed to products of combustion should wear full firefighting turn out gear and self-contained breathing apparatus. Firefighting equipment should be thoroughly decontaminated after use. • **Suitable extinguishing media**: water, carbon dioxide, dry chemical powder or foam as appropriate for surroundings. • **Special hazards caused by the material, its products of combustion or resulting ga**ses: In the event of a fire, the following may be released: Carbon dioxide, Carbon monoxide or other toxic gases. • **Protective equipment**: Wear self-contained breathing apparatus for firefighting if necessary. In general, graphite is difficult to combust. Standard care should be taken to avoid dust explosion risk through high concentrations of dust or finely suspended airborne particle. However, graphite dust is not normally considered an explosion hazard.

6. Accidental Release Measures

Person Related Safety Precautions	Wear suitable protective equipment. Wear suitable respiratory equipment according to Health and Safety Executive guidelines for use of nanomaterials at work. Ensure appropriate ventilation in the working area and avoid raising dust. If the operator gets in contact with the materials, it is recommended to seek a full body shower as soon as possible where skin and hair can be washed with water and soap.
Environmental Precautions	The product should not enter drains. Advise local authorities if large spills cannot be contained.
Methods for Cleaning and Collecting	Clean small spillage with water and detergent or a wet cloth. For larger spillages, use ATEX rated vacuum cleaner equipped with HEPA filter. Clean spillage area with water and detergent. Wastes and contaminated items should be double bagged, sealed and disposed as hazardous waste.

7. Handling and Storage

Handling	Avoid creating dust during handling, transfer or clean up and prevent dust accumulation e. g. by wetting and careful handling. Avoid agitation when dry or in an uncovered liquid. Avoid ultrasonication treatment in an open container. Avoid contact with eyes, skin and reduce aeration of dust wherever inhalation of dust is possible. Handling in nanoparticle should be performed in a nanoparticle filter cabinet.
Storage	Keep away from oxidizing agents, ignition sources and heat. Avoid contact with acids. Keep in a cool, dry and well-ventilated area. Keep containers tightly closed and store in correctly labelled containers.

8. Exposure Controls and Personal Protection

Exposure Guidelines	Not yet established. Keep exposure as low as it is technically feasible. For information, levels for graphite are: Graphite (CAS no. 7782-42-5) TWA: ACGIH (TLV): 2.0 mg/m^3 respirable OSHA (PEL): 15 mL/m^3 respirable
Storage	Keep away from oxidizing agents, ignition sources and heat. Avoid contact with acids. Keep in a cool, dry and well-ventilated area. Keep containers tightly closed and store in correctly labelled containers.
Engineering Measures	Local Exhaust Ventilation should be used, ducted fume cabinets or nanoparticle filter cabinets with a H14 HEPA filter is recommended. If this is not practical respiratory protection must be worn.
Respiratory Protection	Suitable full face protection with P3 (EN143) / N100 filter or other respiratory protection that meets applicable OHSA requirements should be maintained in the workplace.
Hand Protection	Single use nitrile or vinyl gloves should be worn.
Eye Protection	Approved safety goggles / safety glasses.
Skin Protection	Wear disposable protective clothing that does not retain dust.

8. Exposure Controls and Personal Protection (continued)

Environmental Exposure	Environmental exposure should be minimized using the engineering measures identified above. Solid waste should be packaged as above and disposed of as hazardous waste.

9. Physical and Chemical Properties

Appearance	Grey or black agglomerated powder, some ultrafine particles OSHA (PEL): 15 mL/m^3 respirable
Odour	Odourless. Could sometimes present a burned-like smell.
Melting Point	approximately 3,600 ^oC
Flash Point	Not applicable
Boiling Point	Not applicable
Vapour Density	Not applicable
Bulk Density	Not determined
Solubility in Water	Not soluble
Evaporation Rate	Not applicable
Ignition Temperature	Dispersed dust cloud: >600^oC, deposited dust: >365^oC

10. Stability and Reactivity

Stability	This material is considered stable under normal and anticipated storage and handling conditions.
Materials to Avoid	Avoid contact with strong oxidizing agents, halogens, alkali metals and acids.
Conditions to Avoid	Heat and open flames
Hazardous decomposition products	There is not known hazardous decomposition products.

11. Toxicological Information

Toxicological Information	The hazards associated with graphene have not yet been fully established.
Acute Toxicity	Based on information for similar materials, inhaling graphene may cause irritation to the respiratory system. May cause irritation to skin, eyes and mucous membrane.
Repeat Exposure	No quantitative data are available for this material, but toxicological tests of similar materials such as carbon nanotubes have suggested that exposure can produce an inflammatory response in rats and mice, resulting in a fibrogenic response and other adverse health effects in the mesothelium.

12. Ecological Information

Eco-toxicity	No data are available on this product
Mobility	Is expected to be limited due to poor water solubility.

12. Ecological Information (continued)

Degradation	No data are available on this product.
Bioaccumulation	No data are available on this product.
Further Information	No environmental risk is expected if the product is handled under the described conditions

13. Disposal Considerations

General Information	Do not allow product to enter drains. Do not flush into surface water.
Disposal Methods	Dispose of this product and all contaminated materials in compliance with all local and national regulations. In the European Union, waste carbon nanotubes material should be classified and coded as hazardous waste. Based on current information, high temperature incineration in a hazardous waste incinerator is the preferred disposal method. Heating above 550°C will oxidize CNTs completely.

14. Transport Information

Further Information	This product is not classified as dangerous for carriage. Transport in an airtight container, package in at least two layers, i.e. double bagged. Protect contents from spilling and packaging damage which might result in material escape using a suitable carriage system. Clearly label packaging and keep an MSDS on the outside off all packaging.
Other	There is no CAS code currently assigned to this specific material, related CAS codes and descriptions include; (Fullerene CAS# 99685-96-8) (Synthetic Graphite CAS# 7782-42-5)

15. Regulatory Information

Labelling	Samples may contain PAHs classified as hazardous to health according to EU and UK chemicals legislation.
Safety Phrases S38	In case of insufficient ventilation, wear suitable respiratory equipment.

The information supplied in this safety data sheet is designed only as guidance for the safe use, storage and handling of the product. This information is correct to the best of our knowledge and belief at the date of publication however no guarantee is made to its accuracy. This information relates to the specific material designated and may not be valid for such materials used in combination with any other materials or in any other process. NO WARRANTY OF FITNESS FOR ANY PARTICULAR PURPOSE, WARRENTY OF MECHANTABILITY, OR ANY OTHER WARRANTY, EXPRESSED OR IMPLIED, IS MADE CONCERNING THE INFORMATION PROVIDED HEREIN.

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