

Safety Data Sheet

Stanford Advanced Materials

1 - Identification of Substance:

Chemical Name: Graphene Oxide
Formula: Carbon
Chemical Family: Synthetic Graphite
Synonyms: Graphene, Graphene Oxide, Reduced Graphene Oxide
CAS Number: 7782-42-5 (Graphite)

! **Manufacturer/Supplier:**

Stanford Advanced Materials

Address : 23661 Birtcher Dr.,

! Lake Forest, CA 92630 U.S.A.

! Tel: (949) 407-8904

! Fax: (949) 812-6690

www.samaterials.com

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All Materials Sold by Stanford Advanced Materials Only.

2 - Hazards Identification

Potential Health Effects



2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Eye irritation (Category 2A),

H319 Carcinogenicity (Category 2),

H351 Specific target organ toxicity - single exposure (Category 3), Respiratory system,

H335 For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements Pictogram

Signal word: **Danger**

Warning Hazard statement(s)

H319 Causes serious eye irritation.

H335 May cause respiratory irritation.

H351 Suspected of causing cancer.

Precautionary statement(s)

P201 Obtain special instructions before use.

P202 Do not handle until all safety precautions have been read and understood.

P261 Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.

P264 Wash skin thoroughly after handling.

P271 Use only outdoors or in a well-ventilated area.

P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.

P304 + P340 + P312 IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.

P305 + P351 + P338 IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.

P308 + P313 IF exposed or concerned: Get medical advice/ attention.

P337 + P313 If eye irritation persists: Get medical advice/ attention.

P403 + P233 Store in a well-ventilated place. Keep container tightly closed.

P405 Store locked up.

P501 Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3 - Composition/Data on Components:

! **Chemical characterization:**

Description: (CAS#)

Graphite (CAS# 7782-42-5 , 99.9%)

Component	%	OSHA/PEL	ACGIH/TLV
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Graphite	Up to 100%	15 mg/m ³ (total dust) 5 mg/m ³ (respirable fraction)	2 mg/m ³ TWA
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Metallic impurity	Balance		
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*Exposure limits based on synthetic graphite

4 - First Aid Measures

! **After inhalation**

Remove to fresh air. If required, provide artificial respiration. Keep patient warm. Seek immediate medical advice.

! **After skin contact**

Immediately wash with water and soap and rinse thoroughly. Seek immediate medical advice.

! **After eye contact**

Rinse opened eye for several minutes under running water. Then consult a doctor.

! **After swallowing** Seek immediate medical advice.

5 - Fire Fighting Measures

Flash Point: Not applicable.

Explosion Limits: Unknown

Extinguisher Medium: Water, Carbon Dioxide, Dry Chemical, or Foam

Special Procedures: None

Decomposition Products: Carbon Monoxide, Carbon Dioxide

Unusual Hazards: Thermal decomposition or combustion may produce dense smoke.

! **Suitable extinguishing agents**

CO₂, extinguishing powder or water spray. Fight larger fires with water spray.

! **Special hazards caused by the material, its products of combustion or resulting gases:**

In case of fire, the following can be released:

Carbon monoxide (CO)

! **Protective equipment:**

Wear self-contained respirator.

Wear fully protective impervious suit.

NFPA Ratings: Health=1, Flammability=0, Reactivity=1

6 - Accidental Release Measures

! **Person-related safety precautions:**

Wear protective equipment. Keep unprotected persons away.

Ensure adequate ventilation

! **Measures for environmental protection:**

Do not allow material to be released to the environment.

! **Measures for cleaning/collecting:** Ensure adequate ventilation.

! **Additional information:**

See Section 7 for information on safe handling

See Section 8 for information on personal protection equipment.

See Section 13 for disposal information.

7 - Handling and Storage

- ! **Handling:** Use PERSONAL PROTECTIVE EQUIPMENT and exposure controls given in Section 8.
Detailed information on handling carbon nanotubes may be found at the ASTM Standard E 2535 - 07, Standard Guide for Handling Unbound Engineered Nanoscale Particles in Occupational Settings,” ASTM International, West Conshohocken, PA, www.astm.org.
- ! **Storage:** Keep in closed container for storage
- ! **Information for safe handling:**
Keep container tightly sealed.
Store in cool, dry place in tightly closed containers.
Ensure good ventilation at the workplace.
- ! **Information about protection against explosions and fires:**
No Special Requirements
- ! **Requirements to be met by storerooms and receptacles:**
No special requirements.
- ! **Information about storage in one common storage facility:**
Store away from oxidizing agents.
Store away from halogens.
Do not store together with acids.
- ! **Further information about storage conditions:**
Keep container tightly sealed.
Store in cool, dry conditions in well sealed containers.

8 - Exposure Controls and Personal Protection

- ! **Additional information about design of technical systems:**
Properly operating chemical fume hood designed for hazardous chemicals and having an average face velocity of at least 100 feet per minute.

Components with limit values that require monitoring at the workplace:

Graphite mg/m³
ACGIH TLV 2
Belgium TWA 2.5
Finland TWA 5
France VME 2
Germany MAK 6
Ireland TWA 5
Korea TLV 2
Netherlands MAC-TGG 2
Poland TWA 2
Sweden NGV 5 (dust)
Switzerland MAK-W 2.5

United Kingdom 5-LTEL
USA PEL 15 mppcf

! **Additional information:** No data

! **Personal protective equipment**

1. Eye Protection: ANSI 787 rated safety glasses with side-shields
2. Respiratory Protection: NIOSH N-100 or P-100 rated particulate respirator
3. Skin Protection: Nitrile gloves or equivalent and protective clothing to prevent skin contact, such as cotton fiber lab coat or uniform or Tyvek coveralls
4. Ventilation: A local or general exhaust system is recommended.

! **General protective and hygienic measures**

The usual precautionary measures for handling chemicals should be followed.
Keep away from foodstuffs, beverages and feed.
Remove all soiled and contaminated clothing immediately.
Wash hands before breaks and at the end of work.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.

9 - Physical and Chemical Properties:

! **General Information**

! **Form:** Powders

! **Color:** Black

! **Odor:** Odorless

! **Value/Range Unit Method**

! **Change in condition**

! **Melting point/Melting range:** Estimated 3652-3697 ° C (subl/vac)

! **Boiling point/Boiling range:** Not determined

! **Sublimation temperature / start:** Not determined

! **Flash point:** Not applicable

! **Ignition temperature:** Not determined

! **Decomposition temperature:** Not determined

! **Danger of explosion:**

Product does not present an explosion hazard.

Explosion limits:

! **Lower:** Not determined

! **Upper:** Not determined

! **Vapor pressure:** Not determined

! **Density:** at 20 ° C~ 2.1 g/cm³

! **Solubility in / Miscibility with**

! **Water:** Insoluble

10 - Stability and Reactivity

! **Thermal decomposition / conditions to be avoided:**

Decomposition will not occur if used and stored according to specifications.

! **Materials to be avoided:**

Oxidizing agents

Acids

Halogens

Interhalogens

Alkali metals

! **Dangerous reactions** No dangerous reactions known

! **Dangerous products of decomposition:** Carbon monoxide and carbon dioxide

11 - Toxicological Information

! **Acute toxicity:**

! **Primary irritant effect:**

! **On the skin:** Irritant to skin and mucous membranes.

! **On the eye:** Irritating effect.

! **Sensitization:** No sensitizing effects known.

! **Subacute to chronic toxicity:**

The inhalation of graphite, both natural and synthetic, has caused pneumoconiosis in exposed workers. The pneumoconiosis found is similar to coal worker's pneumoconiosis.

! **Additional toxicological information:**

To the best of our knowledge the acute and chronic toxicity of this substance is not fully known.

No classification data on carcinogenic properties of this material is available from the EPA, IARC, NTP,

OSHA or ACGIH.

- ! Toxicological information on graphene may be found at the website of the International Council on Nanotechnology at <http://icon.rice.edu/>

12 - Ecological Information:

- ! **General notes:**

Do not allow this material to be released to the environment.

Ecological information on carbon nanotubes and graphene nanoplatelets may be found at the website of the International Council on Nanotechnology at <http://icon.rice.edu/>

13 - Disposal Considerations

- ! **Product:** Graphene

- ! **Recommendation**

Consult state, local or national regulations to ensure proper disposal. Specific care should be taken to insure that no graphene or graphene packaging is released into the environment.

- ! **Uncleaned packagings:**

- ! Consult all state, local or national regulations to ensure proper disposal. Specific care should be taken to insure that no graphene or graphene packaging is released into the environment.

- ! **Recommendation:**

Disposal must be made according to official regulations. Contact a hazardous materials removal company. Keep all graphene waste, packaging, and contaminated items segregated from other waste and dispose of with a materials removal company such as Saftey Kleen or others.

Recommendation:

Disposal must be made according to official regulations. Contact a hazardous materials removal company. Keep all silver nanowire waste, packaging, and contaminated items segregated from other waste and dispose of with a materials removal company such as Saftey Kleen or others.

14 - Transport Information

Not a hazardous material for transportation.

- ! **DOT regulations:**

- ! **Hazard class:** None

- ! **Land transport ADR/RID (cross-border)**
- ! **ADR/RID class:** None

- ! **Maritime transport IMDG:**
- ! **IMDG Class:**None

- ! **Air transport ICAO-TI and IATA-DGR:**
- ! **ICAO/IATA Class:**None

- ! **Transport/Additional information:**
Not dangerous according to the above specifications.

15 - Regulations

- ! **Product related hazard informations:**

This material is listed on the US Toxic Substances Control Act (TSCA) Inventory and the following chemical inventories: Canadian Domestic Substances List (DSL), European Inventory of Existing Commercial Chemical Substances (EINECS), Korean Existing Chemicals List (ECL), Australian Inventory of Chemical Substances (AICS), the Philippines Inventory of Chemicals and Chemical Substances (PICCS), and the Swiss Giftlist 1 Inventory of Notified New Substances. In addition, this substance is not regulated in Japan and excluded from the Japanese Chemical Substances Control Law according to the Japanese Ministry of Economy, Trade and Industry, formerly the Ministry of International Trade and Industry (MITI).

- ! **Hazard symbols:** Eye Irritant

- ! **Risk phrases:** 36/37 Irritating to eyes and respiratory system.

- ! **Safety phrases:**

26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

- ! **National regulations**

All components of this product are listed in the U.S. Environmental Protection Agency Toxic Substances Control Act Chemical Substance Inventory.

- ! **Information about limitation of use:**

For use only by technically qualified individuals.

16 - Other Information:

Employers should use this information only as a supplement to other information gathered by them, and should make independent judgement of suitability of this information to ensure proper use and protect the health and safety of employees. This information is furnished without warranty, and any use of the product not in conformance with this Material Safety Data Sheet, or in combination with any other product or process, is the responsibility of the user.

HAZARDOUS MATERIALS IDENTIFICATION SYSTEM (HMIS)

Health Flammability Reactivity BASIS

1 0 0 Synthetic graphite powder

NATIONAL FIRE PROTECTION ASSOCIATION (NFPA)

Health Flammability Reactivity BASIS

NFPA Ratings: Health=1, Flammability=0, Reactivity=1

Label Precautions:

Do not get in eyes, on skin or on clothing.

Do not breathe dust.

Wash thoroughly after handling.

Keep container closed.

Use with adequate ventilation.

Label First Aid:

If inhaled, remove to fresh air. If breathing difficulties persist, get medical attention. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. If irritation develops or persists, get medical attention.

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