



SAFETY DATA SHEET

Trade name: Graphene Powder

Revised September, 2021 GP 2.0.c

1. Identification of the substance/mixture and of the company/undertaking

1.1 Product identifier:

Product Name Multi-layer graphene powder

Product Code P-PG20

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

Relevant identified uses of the product For increasing physical properties.

1.3 Details of the supplier of the safety data sheet

Manufacturer/ Supplier Enerage Inc.

Address No.5, Ligong 3rd Rd., Wujie Township, Yilan County 26841, Taiwan, R.O.C.

Phone number 886-3-990-2100

Fax 886-3-990-2500

1.4 Emergency phone number 886-3-990-2100

2. Hazards identification

GHS classification and label elements of the product

2.1 Classification of the substance or mixture

Physical and Chemical hazards

Health hazards Serious Eye Damage/Eye Irritation Category 2

Specific target organ toxicity, single exposure, respiratory system Category 3

2.2 Label elements



Signal word Warning

Hazard statements H319 Causes serious eye irritation.

H335 May cause respiratory irritation.

Precautionary statements

Prevention

P102 Keep out of reach of children

P201 Obtain special instructions before use

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

P233 Keep container tightly closed.

P240 Ground/bond container and receiving equipment.

P243 Take precautionary measures against static discharge.



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- P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
- P270 Do not eat, drink or smoke when using this product
- P271 Use only outdoors or in a well-ventilated area.
- P272 Contaminated work clothing should not be allowed out of the workplace.
- P280 Wear protective gloves/protective clothing/eye protection/face protection
- P281 Use personal protective equipment as required.
- P284 Wear respiratory protection
- P285 In case of inadequate ventilation wear respiratory protection

Response

- P301 IF SWALLOWED P330 Rinse mouth.
- P331 Do NOT induce vomiting.
- P313 Get medical advice/attention
- P303 IF ON SKIN (or hair) P351 Rinse cautiously with water for several minutes.
- P352 Wash with plenty of soap and water.
- P304 IF INHALED P314 Call a POISON CENTER/doctor if you feel unwell.
- P340 Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- P305 IF IN EYES P338 Remove contact lenses, if present and easy to do. Continue rinsing.
- P351 Rinse cautiously with water for several minutes.
- P337 If eye irritation persists P313 Get medical advice/attention.

Storage

- P402 Store in a dry place.
- P403 Store in a well-ventilated place.
- P404 Store in a closed container.
- P405 Store locked up.

Disposal

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

3. Composition/information on ingredients

<u>Chemical name</u>	<u>CAS No.</u>	<u>Content (wt%)</u>
Graphene	1034343-98-0	97~100

4. First-aid measures

4.1 Descriptions of first-aid measures

- General measures In the case of prolonged irritation or other adverse effects, contact a doctor.
- IF ON SKIN (or hair) Wash with soap and water.
- If skin irritation occurs, get medical advice/ attention.
- Contaminated clothing should be removed and washed thoroughly before re-use.
- IF INHALED Remove from exposure to fresh air and call a poison center/ doctor to get medical



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advice/ attention.

If breathing is difficult, administer oxygen.

If breathing has stopped, begin artificial respiration immediately, and seek medical attention.

IF IN EYES

Flush eyes with water for at least 15 minutes.

If easy to do, remove contact lens.

Get medical attention

IF SWALLOWED

Rinse mouth with water and consult a physician.

Never give anything to an unconscious person.

4.2 Most important symptoms/ effects, acute and delayed

Symptoms

No data available.

Hazards

No information about adverse effects due to exposure

4.3 Indication of immediate medical attention and special treatment needed.

Treatment

No data available.

5. Fire-fighting measures

5.1 Extinguishing media

Suitable extinguishing media

Water, carbon dioxide, dry chemical powder or alcohol resistant foam.

Unsuitable extinguishing media

No data available

5.2 Specific 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).

5.3 Advice for firefighters

Special protective equipment and precautions for fire-fighters

Firefighters must use standard protective equipment including flame retardant coat, helmet with face shield, gloves, rubber boots, and in enclosed spaces, SCBA.

Specific fire-fighting measures

Cool containers exposed to flames with water until well after the fire is out.

In case of fire and/or explosion do not breathe fumes.

Water may be ineffective in fighting the fire.

6. Accidental release measures

6.1 Personnel precautions, protective equipment and emergency procedures

Evacuate personnel to safe areas.

Restrict personnel entering the contaminated areas till cleaning.

Cleaning should be executed by the well-trained people.

Remove all sources of ignition if safe to do.

Should wear suitable protective equipment to prevent inhalation or skin contact.

Should beware of the risk of slippage due to the material's low coefficient of friction.

Keep upwind.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so.



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- 6.3 Methods and materials for containment and cleaning up
- Do not contaminate water sources or sewer.
 - Avoid discharge into drains, water courses or onto the ground
 - Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.
 - Do not discharge into storm or sanitary sewers or groundwater.

7. Handling and storage

7.1 Precautions for safe handling

Preventive measures

(Exposure Control for handling personnel)

Do not breathe dust/fume/gas/mist/vapors/spray.

Avoid breathing dust/fume/gas/mist/vapors/spray.

(Protective measures against fire and explosion)

Keep away from heat/sparks/open flames/hot surfaces. - No smoking.

Ground/bond container and receiving equipment.

Use explosion-proof electrical/ventilating/lighting equipment.

Use only non-sparking tools.

Take precautionary measures against static discharge.

Safety Measures/Incompatibility

Obtain special instructions before use.

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

Use only outdoors or in a well-ventilated area.

Wear protective gloves and face protection.

Use personal protective equipment as required.

Remove contaminated clothing and wash the skin thoroughly with soap and water after work.

7.2 Conditions for safe storage, including any incompatibilities

Recommendation for storage

Store in a well-ventilated place and keep cool.

Keep container tightly closed

Store locked up.

Graphene is electrically conductive. Avoid accumulations of graphene in places where these accumulations could cause shorting of electrical switches, circuits or components since any dust can form a potentially explosive mixture in air.

8. Exposure controls/personal protection

8.1 Engineering controls

Provide adequate workplace ventilation. If vapor/dusts are generated through handling, local exhaust ventilation should be employed.

Eye wash facilities and emergency shower must be available when handling this product.

Respiratory protection may be needed for non-routine or emergency situations.



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8.2 Exposure controls

<u>Components</u>	<u>Type</u>	<u>Exposure limit(s)</u>	<u>Source</u>
Graphene	TWA/TLV	2.0 mg/m ³	USA ACGIH
	TWA/REL	2.5 mg/m ³	USA NIOSH
	TWA	15 mg/m ³ (Total dust)	USA OSHA Occupational Exposure Limits - Table Z-1 Limits for Air Contaminants
	TWA	15 mg/m ³ (Respirable fraction)	USA OSHA Occupational Exposure Limits - Table Z-1 Limits for Air Contaminants
	TWA	15.0 mppcf (million particles per cubic foot)	USA OSHA Occupational Exposure Limits - - Table Z-3 Mineral Dusts

8.3 Personal protective Equipment

General

Good general ventilation (typically 10 air changes per hour) should be used. Ventilation rates should be matched to conditions.

If applicable, use process enclosures, local exhaust ventilation, or other engineering controls to maintain airborne levels below recommended exposure limits.

If exposure limits have not been established, maintain airborne levels to an acceptable level.

An eye wash and safety shower must be available in the immediate work area.

Respiratory protection

To minimize risk of over exposure to dust, vapor or fumes, it is recommended that a local exhaust system is placed above the equipment, and that the working area is properly ventilated.

If ventilation is inadequate, use certified respirator that will protect against dust/mist.

Eye/face protection

Wear suitable safety eyeglasses or chemical protective goggles or other face protection.

Skin and body protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place.

Hand protection

Handle with gloves. Gloves must be inspected prior to use.

Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product.

Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices.

Hygiene

Do not eat, drink or smoke when using the product.

Wash hands after handling.

Observe good industrial hygiene practices.

9. Physical and Chemical Properties

9.1 Information on basic physical and chemical properties



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Appearance	Powder
Color	Gray to black
Odor	None
Odor threshold	No data available
pH	No data available
Melting point	Graphene: >3600°C
Initial boiling point	No data available
Flash point	No data available
Auto-ignition temperature	Dispersed dust cloud: >600°C
Flammability (solid, gas)	No data available
Flammable limit	No data available
Evaporation rate	No data available
Vapor density	No data available
Vapor pressure	No data available
Decomposition temperature	No data available
Density	2.2 g/cm ³ @20°C
Tap density	0.01~0.05 g/cm ³
Solubility in water	Insoluble
Solubility (other)	No data available
Partition coefficient (n-Octanol/water)	No data available

Closed cup



10. Stability and Reactivity

10.1 Reactivity	Stable under recommended storage conditions.
10.2 Chemical stability	No decomposition if stored and applied as directed.
10.3 Possibility of hazardous reactions	No dangerous reaction known under conditions of normal use.
10.4 Conditions to avoid	Agglomeration generated near/on power and electronic circuits.
10.5 Incompatible materials	Strong oxidizing agents.
10.6 Hazardous decomposition products	Mainly carbon oxides occur under high temperature/fire conditions.

11. TOXICOLOGICAL INFORMATION

11.1 Information on the likely routes of exposure

Inhalation	No data available.
Ingestion	No data available.
Skin contact	No data available.



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Eye contact No data available.

11.2 Symptoms related to the physical, chemical and toxicological characteristics

Inhalation No data available.

Ingestion No data available.

Skin contact No data available.

Eye contact No data available.

11.3 Information on toxicological effects

Acute toxicity

Dermal No data available.

Oral OECD Guideline 423, LD 50, Female rat: >2,000 g/kg

Inhalation OECD Guideline 403, LC 50, Male and female rat, 4 h: 2,000 mg/m³

Skin Corrosion/Irritation Rabbit: No skin irritation.

Serious Eye Damage/Eye Rabbit: No eye irritation.

Irritation

Respiratory or skin sensitization Mouse: Did not cause sensitization on laboratory animals.

Germ cell mutagenicity

in vitro S. typhimurium: Negative.

in vivo No mutagenic components identified.

Carcinogenicity

IARC No component of this product presents at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

NTP No component of this product presents at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by NTP.

OSHA No component of this product presents at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by OSHA.

Reproductive toxicity No data available.

Specific target organ toxicity

Single exposure Inhalation, may cause respiratory irritation.

Repeated exposure No data available.

Aspiration hazard No data available.

Other effects Repeated dose toxicity, Male rat, Feed: No observed adverse effect level, 813 mg/kg

12. Ecological Information

12.1 Ecotoxicity

Fish

Specific substance(s)



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Graphene	OECD Test Guideline 203, Semi-static test, LC 50, Danio rerio (zebra fish), 96 h: >100 mg/l
Aquatic invertebrates	
Specific substance(s)	
Graphene	OECD Test Guideline 202, Static test, EC 50, Daphnia magna (Water flea), 48 h: >100 mg/l
Algae	
Specific substance(s)	
Graphene	OECD Test Guideline 201, Static test, EC50, Pseudokirchneriella subcapitata, 72h: >100 mg/l
12.2 Persistence and degradability	
Biodegradation	No data available.
BOD/ThBOD	No data available.
12.3 Bioaccumulative potential	
Bioconcentration factor (BCF)	No data available.
Partition coefficient n-octanol/water	No data available.
12.4 Mobility in soil	No data available.
12.5 Results of PBT and vPvB assessment	This substance/mixture contains no components considered to be either persistent, bioaccumulative and toxic (PBT), or very persistent and very bioaccumulative (vPvB) at levels of 0.1% or higher.
12.6 Other adverse effects	No data available.
13. Disposal considerations	
13.1 Waste Code	No data available.
13.2 Disposal methods	Dispose of only in accordance with local, state, and federal regulations. Do not contaminate any lakes, streams, ponds, groundwater or soil. No mixing with other waste. Leave chemicals in original containers.
13.3 Empty containers	Empty containers retain product residue (liquid and/or vapor) and can be dangerous. DO NOT PRESSURIZE, CUT, WELD, BRAZE, SOLDER, DRILL, GRIND, OR EXPOSE SUCH CONTAINERS TO HEAT, FLAME, SPARKS, STATIC ELECTRICITY, OR OTHER SOURCES OF IGNITION; THEY MAY EXPLODE AND CAUSE INJURY OR DEATH. Empty drums should be completely drained, triple-rinsed, properly bunged and promptly returned to a drum reconditioner, or properly disposed.

14. Transport Information



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DOT (U.S. Department of Transportation)

UN number	No data available.
UN proper shipping name	No data available.
Transport hazard class(es)	
Class	No data available.
Label(s)	No data available.
Packing group	No data available.
Material pollutant	No data available.
Special precaution for user	No data available.

IATA (International Air Transport Association)

UN number	No data available.
UN proper shipping name	No data available.
Transport hazard class(es)	
Class	No data available.
Label(s)	No data available.
Packing group	No data available.
Material pollutant	No data available.
Special precaution for user	No data available.

IMDG (International Maritime Dangerous Goods)

UN number	No data available.
UN proper shipping name	No data available.
Transport hazard class(es)	
Class	No data available.
Label(s)	No data available.
EmS No.	No data available.
Packing group	No data available.
Material pollutant	No data available.
Special precaution for user	No data available.

14.1 Environmental hazards

MARPOL Annex III - Prevention of pollution by harmful substances

Marine pollutants (yes/no) no

14.2 Special precautions for user No data available.

14.3 Transport in bulk according to Annex II of MARPOL73/78 and IBC Code

Remarks No data available.

15. Regulatory Information



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15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard

15.2 Chemical Safety Assessment

For this product a chemical safety assessment was not carried out.

International Regulations

WHMIS classification

Flammable liquids	No data available.
Eye irritation	No data available.
Specific target organ toxicity - single exposure	No data available.

European Union

Flammable liquids	No data available.
Eye irritation	No data available.
Specific target organ toxicity - single exposure	No data available.

Montreal protocol

Not applicable

Stockholm convention

Not applicable

Rotterdam convention

Not applicable

Kyoto protocol

Not applicable

Inventory status

Australia	Inventory of Chemical Substances (AICS)	No data available.
Japan	The inventory of existing and new chemical substances (ENCS)	No data available.
EU	European Inventory of Existing Commercial Chemical Substances (EINECS)	No data available.
EU	European List of Notified Chemical Substances (ELINCS)	No data available.
EU	No-longer Polymers (NLP)	No data available.
Canada	Domestic Substances List (DSL) Inventory	No data available.
Philippines	Inventory of Chemicals/ Chemical Substances (PICCS)	No data available.
Korea	Existing Chemicals Inventory (KECI)	No data available.



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China	Inventory of Existing Chemical Substances (IECSC)	No data available.
Mexico	National Inventory of Chemical Substances of Mexico (INSQ)	No data available.
New Zealand	Inventory of Chemical Substances	No data available.
Taiwan	National Existing Chemical Inventory (NECI)	No data available.

16. Other Information

Hazard Ratings

	<u>Health</u>	<u>Flammability</u>	<u>Physical Hazard/ Instability</u>
HMIS	1	0	0
NFPA	1	0	0

Hazard rating: 0 - Minimal; 1 - Slight; 2 - Moderate; 3 - Serious; 4 - Severe; RNP - Rating not possible

Date of the latest revision 2021/04/13

DISCLAIMER:

This information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any process. Information contained in this Safety Data Sheet is to the best of our knowledge and believed to be reliable but no representation, guarantee or warranties of any kind are made as to its accuracy, suitability for a particular application etc. It is up to the user/distributor to ensure that the information contained in the material safety data sheet is relevant to the product manufactured or sold as the case may be. Enerage Inc. makes no warranties, expressed or implied, in respect of the adequacy of this document for any particular purpose.

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