



# SAFETY DATA SHEET

## Trade name: Graphene Thermal Grease

Revised September, 2021 GP 2.0.c

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

#### 1.1 Product identifier:

Product Name Graphene Thermal Grease, Thermal Grease  
Product Code G-TG11

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

Relevant identified uses of the product For Dissipating Thermal Energy From Heating Device.

#### 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

According to Regulation (EC) No 1272/2008 H400 Short-term (acute) aquatic hazard Category 1

H410 Long-term (chronic) aquatic hazard Category 1

#### 2.2 Label elements



Signal word Warning

Hazard statements H410 Very toxic to aquatic life with long lasting effects..  
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.  
P270 Do no eat, drink or smoke when using this product  
P272 Contaminated work clothing should not be allowed out of the workplace.



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- P273 Avoid release to the environment.
- P280 Wear protective gloves/protective clothing/eye protection/face protection
- P281 Use personal protective equipment as required.

## 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

- P391 Collect spillage.
- P402 Store in a dry place.

## 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>
Aluminum Oxide (Al <sub>2</sub> O <sub>3</sub> )	1344-28-1	50~65
Zinc Oxide (ZnO)	1314-13-2	25~35
Silicone Oil	63148-62-9	5~15
Graphene	1034343-98-0	0.01~5

### 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 advice/ attention.
  - If breathing is difficult, administer oxygen.
  - If breathing has stopped, begin artificial respiration immediately, and seek medical



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	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.
<b>5. Fire-fighting measures</b>	
5.1 Extinguishing media	
Suitable extinguishing media	Water, carbon dioxide, dry chemical powder or alcohol resistant foam.
Unsuitable extinguishing media	Halocarbon Extinguisher.
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 (CO <sub>2</sub> ). Zinc Oxides, silicon Oxides
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.
<b>6. Accidental release measures</b>	
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. Do not contaminate water sources or sewer. Avoid discharge into drains, water courses or onto the ground



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6.3 Methods and materials for containment and cleaning up

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 glasses with side-shields conforming to EN166.

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

Handle with glove satisfying the specifications of Regulation (EU) 2016/425 and the standard EN 374.



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Respiratory protection, tested and approved under NIOSH (US) or (CEN (EU), may be needed for non-routine or emergency situations.

### 8.2 Exposure controls

<u>Components</u>	<u>Type</u>	<u>Exposure limit(s)</u>	<u>Source</u>
Aluminum Oxide	PEL	15 mg/m <sup>3</sup> (Total dust)	
	PEL	5 mg/m <sup>3</sup> (Respirable fraction)	
	REL	10 mg/m <sup>3</sup> (Total dust)	
	REL	5 mg/m <sup>3</sup> (Respirable/pyro powder/welding fume) )	
Zinc Oxide	TLV	1 mg/m <sup>3</sup> (Respirable fraction)	
	CEIL/REL	15 mg/m <sup>3</sup> (Dust)	USA NIOSH 10/2013
	TWA/REL	5 mg/m <sup>3</sup> , 10 hr (Dust & Fumes)	USA NIOSH 10/2013
	STEL/TLV	10 mg/m <sup>3</sup> , 15 min (Fumes)	USA ACGIH 4/2014
	TWA/TLV	2 mg/m <sup>3</sup> , 8 hr (Respirable fraction)	USA ACGIH 4/2014
	TWA/PEL	5 mg/m <sup>3</sup> , 8 hr (Fumes)	USA OSHA 2/2013
	TWA/PEL	5 mg/m <sup>3</sup> , 8 hr (Respirable fraction)	USA OSHA 2/2013
	TWA/PEL	15 mg/m <sup>3</sup> , 10 hr (Total Dust)	USA OSHA 2/2013
Graphene	STEL/PEL	10 mg/m <sup>3</sup> , 15 min (Respirable fraction)	USA OSHA 2/2013
	TWA/TLV	2.0 mg/m <sup>3</sup>	USA ACGIH
	TWA/REL	2.5 mg/m <sup>3</sup>	USA NIOSH
	TWA	15 mg/m <sup>3</sup> (Total dust)	USA OSHA Occupational Exposure Limits - Table Z-1 Limits for Air Contaminants
	TWA	15 mg/m <sup>3</sup> (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.



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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

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	2.3 g/cm <sup>3</sup> @20°C
Tap density	No data available
Solubility in water	Insoluble



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Solubility (other)	No data available
Partition coefficient (n-Octanol/water)	No data available

### 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.
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	OECD Guideline 402, LD 50, Male & Female rat: >2,000 mg/kg
Oral	OECD Guideline 423, LD 50, Male & Female rat: >2,000 mg/kg
Inhalation	US EPA, LC 50, Male and female rat, 4 h: >1.79 mg/l

Skin Corrosion/Irritation	Rabbit: No skin irritation.
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Serious Eye Damage/Eye Irritation	Rabbit: No eye irritation.
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Respiratory or skin sensitization	Mouse: Did not cause sensitization on laboratory animals.
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##### Germ cell mutagenicity

in vitro	No biologically relevant genotoxic activity.
in vivo	No biologically relevant genotoxic activity.





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### 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 evidence of reproduction toxicity.

### Specific target organ toxicity

Single exposure None

Repeated exposure None.

### Aspiration hazard

No data available.

### Other effects

Repeated dose toxicity - Rat - male and female - Oral - 13 Weeks - No observed adverse effect level - 31,52 mg/kg (in analogy to similar products)

Repeated dose toxicity - Rat - male - Inhalation - 3 Months

Repeated dose toxicity - Rat - male and female - Dermal - 28 d - Lowest observed adverse effect level - 75 mg/kg

RTECS: ZH4810000

## 12. Ecological Information

### 12.1 Ecotoxicity

#### Fish

##### Specific substance(s)

Zinc Oxide ECHA, semi-static test, LC50 - Danio rerio (zebra fish), 2,525 mg/l, 96 h

Graphene OECD Test Guideline 203, Semi-static test, LC 50, Danio rerio (zebra fish), 96 h: >100 mg/l

#### Aquatic invertebrates

##### Specific substance(s)

Zinc Oxide OECD Test Guideline 202, Daphnia magna (Water flea), 1 mg/l, 48 h

Graphene OECD Test Guideline 202, Static test, EC 50, Daphnia magna (Water flea), 48 h: >100 mg/l

#### Algae

##### Specific substance(s)

Zinc Oxide OECD Test Guideline 201, Static test NOEC, EC50, Pseudokirchneriella subcapitata (microalgae), 72h: 0.024 mg/l

Graphene OECD Test Guideline 201, Static test, EC50, Pseudokirchneriella subcapitata, 72h: >100





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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 No data available.

n-octanol/water

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 Toxic to aquatic life with long lasting 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

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.



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Special precaution for user No data available.

### IATA (International Air Transport Association)

UN number No data available.

UN proper shipping name Environmentally hazardous substance, solid, n.o.s. (Zinc oxide)

### Transport hazard class(es)

Class 9

Label(s) No data available.

Packing group III

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 ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Zinc oxide)

### Transport hazard class(es)

Class 9

Label(s) III

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) Yes

14.2 Special precautions for user EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packaging and combination packaging containing inner packaging with Dangerous Goods > 5L for liquids or > 5kg for solids.

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

Remarks No data available.

## 15. Regulatory Information

### 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.



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## 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 - No data available.

single exposure

### European Union

Flammable liquids No data available.

Eye irritation No data available.

Specific target organ toxicity - No data available.

single exposure

### 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.

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



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	<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:

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