



# SAFETY DATA SHEET

Trade name: Graphene Ink

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 ink
Product Code	I-EP33

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

Relevant identified uses of the product I-EP33 is designed for spray printed flex circuit and electronic device applications.

### 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

Health hazards	Eye Irritation	Category 2
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#### 2.2 Label elements



Signal word Warning

Hazard statements H319 Causes serious eye irritation.

#### Precautionary statements

- P202 Do not handle until all safety precautions have been read and understood
- 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.
- P273 Avoid release to the environment.
- P280 Wear protective gloves/protective clothing/eye protection/face protection

#### Response

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

#### Storage

P402 Store in a dry place.



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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>
Resin	-	5~20
Graphene	1034343-98-0	2~30
Carbon Black	1333-86-4	2~30
Dimethyl Glutarate	1119-40-0	50~60
Dimethyl adipate	627-93-0	10~25
Dimethyl succinate	106-65-0	10~25

### 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 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

May cause irritation to eyes.

Hazards

No information about adverse effects due to exposure

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

Treatment

Symptoms may be delayed. Treat symptomatically.

### 5. Fire-fighting measures

#### 5.1 Extinguishing media



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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	<p>In the event of combustion or thermal decomposition, this material may release carbon monoxide (CO) or carbon dioxide (CO<sub>2</sub>).</p> <p>Flammable liquid and vapor.</p> <p>Can be ignited easily and burns vigorously.</p> <p>Vapors may cause a flash fire or ignite explosively.</p> <p>Vapors may travel considerable distance to a source of ignition and flash back.</p> <p>Prevent buildup of vapors or gases to explosive concentrations.</p>
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	<p>Cool containers exposed to flames with water until well after the fire is out.</p> <p>In case of fire and/or explosion do not breathe fumes.</p> <p>Keep away from any heat source or electronic circuits.</p> <p>Water may be ineffective in fighting the fire.</p>
<b>6. Accidental release measures</b>	
6.1 Personnel precautions, protective equipment and emergency procedures	<p>Evacuate personnel to safe areas.</p> <p>Remove all sources of ignition if safe to do.</p> <p>Should wear suitable protective equipment to prevent inhalation or skin contact.</p> <p>Should beware of the risk of slippage due to the material's low coefficient of friction.</p> <p>Keep upwind.</p>
6.2 Environmental precautions	<p>Prevent further leakage or spillage if safe to do so.</p> <p>Do not contaminate water sources or sewer.</p> <p>Avoid discharge into drains, water courses or onto the ground</p>
6.3 Methods and materials for containment and cleaning up	<p>Collect spillage with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations.</p> <p>Do not discharge into storm or sanitary sewers or groundwater.</p>
<b>7. Handling and storage</b>	
7.1 Precautions for safe handling	
Preventive measures	<p>(Exposure Control for handling personnel)</p> <p>Do not breathe dust/fume/gas/mist/vapors/spray.</p> <p>Avoid breathing dust/fume/gas/mist/vapors/spray.</p>



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(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.

## 8. Exposure controls/personal protection

### 8.1 Engineering controls

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits CAS# 1119-40-0: Personal Protective Equipment Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

### 8.2 Exposure controls

<u>Components</u>	<u>Type</u>	<u>Exposure limit(s)</u>	<u>Source</u>
Dimethyl Glutarate	C	10 mg/m <sup>3</sup>	US. ACGIH TLV

### 8.3 Personal protective Equipment

Eye Protection: Personal

Protection Equipments (PPE)

Where there is significant potential for eye contact, wear chemical goggles and have eye flushing equipment available.

Skin Protection: Personal

Protection Equipments (PPE)

Although this product does not present significant skin concern, minimize skin contamination by following good industrial practice. Wearing protective gloves is recommended. Wash hands and contaminated skin thoroughly after handling.

Respiratory Protection: Personal

Protection Equipments (PPE)

Avoid breathing vapor or mist. Use NIOSH/MSHA approved respiratory protection equipment when airborne limits are exceeded (see above). Consult the respirator manufacturer to determine the appropriate type of equipment for a given application.



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Observe respirator use limitations specified by NIOSH/MSHA or the manufacturer.

Respiratory protection programs must comply with 29 CFR 1910.134.

### 9. Physical and Chemical Properties

#### 9.1 Information on basic physical and chemical properties

Appearance	Gray or black inks
Color	Gray to black
Odor	Sweet
Odor threshold	No data available
pH	No data available
Melting point	Dimethyl Glutarate: -4 °F Graphene: >3600°C
Initial boiling point	Dimethyl Glutarate: 196~225°C
Flash point	Dimethyl Glutarate: 103.0 °C
Auto-ignition temperature	Dimethyl Glutarate: 370 °C Graphene: dispersed dust cloud: >600°C
Flammability (solid, gas)	No data available
Flammable limit	0.9~8.0 %(V)
Evaporation rate	<0.1 (butyl acetate=1)
Vapor density	Not determined
Vapor pressure	0.01 kPa @ 20°C
Decomposition temperature	No data available
Density	0.9~1.2 g/cm <sup>3</sup> @20°C
Solubility in water	Dimethyl Glutarate: 5.3% w/w @ 20°C Graphene: Insoluble
Solubility (other)	No data available
Partition coefficient (n-Octanol/water)	log Pow: 0.19 at 25°C

### 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	Heat, flames and sparks.
10.5 Incompatible materials	Strong oxidizing agents, Alkali metals, Strong acids, Nitrates.
10.6 Hazardous decomposition	Mainly carbon oxides occur under high temperature/fire conditions.



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## 11. TOXICOLOGICAL INFORMATION

### 11.1 Information on the likely routes of exposure

Inhalation	May cause irritation to the respiratory system. May cause drowsiness or dizziness.
Ingestion	Irritating. May cause nausea, stomach pain and vomiting.
Eye contact	Causes serious eye irritation.

### 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	LD 50, Rabbit: >2250 mg/kg
Oral	LD 50, Rat: >5000 mg/kg
Inhalation	LC 50, Rat, 4 h: 10.7 mg/l

Serious Eye Damage/Eye Causes serious eye irritation.

#### Irritation

Respiratory or skin sensitization Not a skin sensitizer.

Reproductive toxicity No components toxic to reproduction

#### Specific target organ toxicity

Single exposure	No data available.
Repeated exposure	No data available.
Aspiration hazard	No data available.
Other effects	No data available.

## 12. Ecological Information

### 12.1 Ecotoxicity

#### Aquatic invertebrates

##### Specific substance(s)

Dimethyl Glutarate EC 50, Daphnia (Water flea), 48 h: 17 mg/l

#### Algae

##### Specific substance(s)

Dimethyl Glutarate EC 50, Algae, 72 h: 46.9 mg/l

### 12.2 Persistence and degradability

Biodegradation Readily biodegradable, according to appropriate OECD test. Assessment of biological



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degradability (Closed-Bottle Test): 87% after 28 days.

## 12.3 Bioaccumulative potential

Bioaccumulation	No data available
Bioconcentration factor (BCF)	No data available on bioaccumulation.
Partition coefficient n-octanol/water	No data available

12.4 Mobility in soil No data available.

12.5 Results of PBT and vPvB assessment 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	Dispose of as unused product.

## 14. Transport Information

DOT (U.S. Department of Transportation)

UN number	-
UN proper shipping name	Not dangerous goods
Transport hazard class(es) Class	-
Label(s)	No data available
Packing group	-
Material pollutant	No
Special precaution for user	-

### 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 I or II of MARPOL 73/78 and the IBC or IGC Code

Remarks No data available.



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## 15. Regulatory Information

This safety datasheet complies with the requirements of Regulation (EC) No. 1907/2006. International Chemical Weapons Convention (CWC) Schedules of Toxic Chemicals and Precursors

Neither banned nor restricted.

REACH - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, preparations and articles (Annex XVII)

Neither banned nor restricted.

Regulation (EC) No 649/2012 of the European Parliament and the Council concerning the export and import of dangerous chemicals

Neither banned nor restricted.

REACH - Candidate List of Substances of Very High Concern for Authorisation (Article 59).

This product does not contain substances of very high concern (Regulation (EC) No 1907/2006 (REACH), Article 57).

This product contains a substance listed on Annex XIV of the REACH Regulation (EC) Nr. 1907/2006. Listed substance / Sunset Date

After the sunset date the use of this substance requires either an authorization or can only be used for exempted uses, e.g. use in scientific research and development which includes routine analytics or use as intermediate.

Regulation (EC) No 1005/2009 on substances that deplete the ozone layer

Neither banned nor restricted.

Regulation (EC) No 850/2004 on persistent organic pollutants

Neither banned nor restricted.

## 16. Other Information

Hazard Ratings

	<u>Health</u>	<u>Flammability</u>	<u>Physical Hazard/ Instability</u>
HMIS	No data available	No data available	No data available
NFPA	No data available	No data available	No data available
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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