



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-WH12

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

Relevant identified uses of the product	A kind of hydrophilic ink designed for screen 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

Physical and Chemical hazards	Flammable liquids	Category 3
Health hazards	Aspiration hazard	Category 2
	Acute toxicity; Oral	Category 5
	Specific target organ toxicity, single exposure	Category 3

2.2 Label elements



Signal word	Danger
Hazard statements	H225 Highly flammable liquid and vapor. H303 May be harmful if swallowed. H336 May cause drowsiness or dizziness.

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 P210 Keep away from heat/sparks/open flames/hot surfaces. - No smoking P211 Do not spray on an open flame or other ignition source. P233 Keep container tightly closed.
------------	---



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

- P240 Ground/bond container and receiving equipment.
- P242 Use only non-sparking tools.
- P261 Avoid breathing dust/fume/gas/mist/vapours/spray.
- P270 Do no 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
- P281 Use personal protective equipment as required.
- 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.
 - P353 Rinse skin with water/shower.
- 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.
- P370 In case of fire
 - P374 Fight fire with normal precautions from a reasonable distance.
 - P376 Stop leak if safe to do so.
 - P378 Use water, carbon dioxide, dry chemical powder or alcohol resistant foam for extinction.

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>
Resin	-	15~40



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

Graphene	1034343-98-0	7~20
Carbon black	1333-86-4	5~10
Propylene glycol monomethyl ether	107-98-2	40~60

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 skin, eyes and respiratory tract.
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

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).
Flammable liquid and vapor.
Can be ignited easily and burns vigorously.
Vapors may cause a flash fire or ignite explosively.
Prevent buildup of vapors or gases to explosive concentrations.

5.3 Advice for firefighters



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

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.
Keep away from any heat source or electronic circuits.

6. Accidental release measures

6.1 Personnel precautions, protective equipment and emergency procedures
Evacuate personnel to safe areas.
Remove all sources of ignition if safe to do.
Should wear suitable protective equipment to prevent inhalation or skin contact.
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

6.3 Methods and materials for containment and cleaning up
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.
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.



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

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 Provide adequate workplace ventilation.
Eye wash facilities and emergency shower must be available when handling this product.
Respiratory protection may be needed for non-routine or emergency situations.

8.2 Exposure controls

Components	Type	Exposure limit(s)	Source
1-Methoxy-2propanol	TWA	50 ppm	US. ACGIH Threshold Limit Values (2013)
	TWA	100 ppm, 369 mg/m3	US. OELs (TW) January 26, 2010
	ST EL	100 ppm	US. ACGIH Threshold Limit Values (2013)
	ST EL	125 ppm	US. OELs (TW) January 26, 2010

PEL:	Permissible Exposure Limits	TWA:	Time Weighted Average (8 hr.)
TLV:	Threshold Limit Value	STEL:	Short Term Exposure Limit (15 min.)

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.

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



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

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	Gray or black inks
Color	Gray to black
Odor	Easter-like
Odor threshold	No data available
pH	No data available
Melting point	1-Methoxy-2propanol: -96°C Graphene: >3600°C
Initial boiling point	1-Methoxy-2propanol: 120 °C
Flash point	1-Methoxy-2propanol: 31°C
Auto-ignition temperature	1-Methoxy-2propanol: 287 °C Graphene: Dispersed dust cloud: >600°C
Flammability (solid, gas)	No data available
Flammable limit	No data available
Evaporation rate	No data available
Vapor density	1-Methoxy-2propanol: 3.11 (air=1.0)
Vapor pressure	1-Methoxy-2propanol: 15.6 hPa @ 25 °C
Decomposition temperature	No data available
Density	0.9~1.2 g/cm ³ @20°C
Solubility in water	1-Methoxy-2propanol: 200g/l Graphene: Insoluble
Solubility (other)	No data available
Partition coefficient (n-Octanol/water)	1-Methoxy-2propanol: log Pow: < 1.0 at 20 °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.



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

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 products	Mainly carbon oxides occur under high temperature/fire conditions.

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.
Skin contact	Causes mild skin irritation.
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: > 20,000 mg/kg
Oral	LD 50, Rat: 4.01 g/kg
Inhalation	LD 50, Rat, 6 h: 25.8 mg/l

Skin Corrosion/Irritation Causes mild skin irritation.

Serious Eye Damage/Eye Irritation Causes serious eye irritation.

Irritation

Respiratory or skin sensitization Not a skin sensitizer.

Germ cell mutagenicity

in vitro	No data available.
in vivo	No mutagenic components identified.

Carcinogenicity This substance has no evidence of carcinogenic properties.

Reproductive toxicity Not classified.

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



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

12.1 Ecotoxicity

Fish	Low acute toxicity to fish
Aquatic invertebrates	Low acute toxicity to aquatic invertebrates.
Algae	Low toxicity to algae.

12.2 Persistence and degradability

No data available.

12.3 Bioaccumulative potential

Bioaccumulation	This material is not expected to bioaccumulate
Bioconcentration factor (BCF)	Bioconcentration factor (BCF): 3.16
Partition coefficient n-octanol/water	No data available.

12.4 Mobility in soil

The product is water soluble and may spread in water systems.

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted.

12.6 Other adverse effects

No data available.

13. Disposal considerations

13.1 Waste Code

No data available.

13.2 Disposal methods

Contaminated product, soil, water, container residues and spill cleanup materials may be hazardous wastes.

Comply with applicable local, state or international regulations concerning solid or hazardous waste disposal and/or container disposal.

Dispose of as hazardous waste in compliance with local and national regulations

13.3 Empty containers

Dispose of as unused product. .

14. Transport Information

TAIWAN_ROAD

UN number	UN 3092
UN proper shipping name	1-Methoxy-2propanol
Transport hazard class(es)	
Class	3
Label(s)	3
Packing group	III
Material pollutant	No

IMDG

UN number	UN 3092
UN proper shipping name	1-Methoxy-2propanol
Transport hazard class(es)	



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

Class	3
Label(s)	3
EmS No.	F-E, S-D
Packing group	III
Material pollutant	No

15. Regulatory Information

Classification: This material is hazardous according to Safe Work Australia; HAZARDOUS CHEMICAL.

International Regulations

Classification of the chemical Flammable liquids-Category 2
 Specific target organ toxicity (single exposure) - Category 3

Hazard Statement(s): H226 Flammable liquid and vapor.
 H336 May cause drowsiness and dizziness.

Poisons Schedule (SUSMP): None allocated.

All the constituents of this material are listed on the Australian Inventory of Chemical Substances (AICS).

Australia	Inventory of Chemical Substances (AICS)	On or in compliance with the inventory
Japan	The inventory of existing and new chemical substances (ENCS)	On or in compliance with the inventory
Canada	Domestic Substances List (DSL) Inventory	On or in compliance with the inventory
Philippines	Inventory of Chemicals/ Chemical Substances (PICCS)	On or in compliance with the inventory
Korea	Existing Chemicals Inventory (KECI)	On or in compliance with the inventory
China	Inventory of Existing Chemical Substances (IECSC)	On or in compliance with the inventory
New Zealand	Inventory of Chemical Substances	On or in compliance with the inventory
Taiwan	National Existing Chemical Inventory (NECI)	On or in compliance with the inventory

16. Other Information

Hazard Ratings

	<u>Health</u>	<u>Flammability</u>	<u>Physical Hazard/ Instability</u>
HMIS	2	3	0
NFPA	2	3	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



SAFETY DATA SHEET

Trade name: Graphene Ink

Revised September, 2021 GP 2.0.c

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.



Graphage