SECTION 1: IDENTIFICATION OF THE PRODUCT AND OF THE COMPANY

1.1 Product identifiers
Product Name : ACS Material CVD Graphene on Copper
Brand : ACS Material LLC
CAS-No. : 7782-42-5 (graphite), 7440-50-8 (copper)

1.2 Relevant identified uses of the substance or mixture and uses advised against
Identified uses : Industrial use, Research use

1.3 Details of the supplier of the safety data sheet
Company : ACS MATERIAL LLC
959 E Walnut Street, Suite 100
Pasadena, CA 91106
USA
Telephone : +1 (866)-227-0656
Fax : +1 (781)-518-0284

1.4 Emergency telephone number
Emergency Phone #: +1 (866)-227-0656

SECTION 2: HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture
Classification according to Regulation (EC) No 1272/2008 [EU-GHS/CLP]
Not a hazardous substance or mixture according to Regulation (EC) No. 1272/2008. This substance is not classified as dangerous according to Directive 67/548/EEC.

2.2 Label elements
This substance is not classified as dangerous according to Directive 67/548/EEC.

2.3 Other hazards
Physical hazards: graphene is electrically conductive. Care should be taken to avoid accumulation of graphite dust in places where these accumulations could cause shorting of electrical circuits, switches, or components.
SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Substance name: ACS Material CVD Graphene on Copper
CAS-No: 7782-42-5 (graphite), 7440-50-8 (copper)
Synonyms: Graphene, Graphene sheets, Exfoliated Graphite, Copper, Cu.

### Description

Graphene film on Copper foil substrate. Graphene (CAS 1034343-98-0) is a thin layer of pure carbon; it is a single, tightly packed layer of carbon atoms that are bonded together to form a hexagonal “honeycomb” lattice. It is a two-dimensional allotrope of carbon in the structure of a plane of sp² bonded atoms with a molecule bond length of 0.142 nanometers (1.42 Angstrom). Layers of graphene stacked on top of each other form graphite, with an interplanar spacing of 0.335 nanometers (3.35 Angstrom).

<table>
<thead>
<tr>
<th>Name</th>
<th>CAS #</th>
<th>EC #</th>
<th>N° Reach</th>
<th>Classification (CLP)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Graphene</td>
<td>1034343-98-0</td>
<td>231-55-93</td>
<td>N/A*</td>
<td>Not Classified**</td>
</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>231-159-6</td>
<td>N/A*</td>
<td>Not Classified</td>
</tr>
</tbody>
</table>

* Annual tonnage does not require registration or the registration is envisaged for a later registration deadline.
** Please note that substance properties used for the hazard assessment of the mixture come from graphite (bulk substance, CAS 7782-42-5). The properties of the nanoform graphene are under evaluation and to some extent not known.

For the full text of the phrases mentioned in this Section, see Section 16.

Hazardous impurities: None known.

SECTION 4: FIRST AID MEASURES

4.1 Description of first aid measures

**General advice**
Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

**If inhaled**
If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

**In case of skin contact**
Flush eyes with water as a precaution.

**If swallowed**
Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed
The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.

4.3 Indication of any immediate medical attention and special treatment needed
Treat as symptoms arise. Contact a poison control center immediately in case of ingestion or inhalation of large amounts of product. Specific treatment: no specific treatment.

SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing media
Suitable extinguishing media
Use carbon dioxide, dry chemical extinguishing agents, dry sand or dry ground dolomite.

5.2 Special hazards arising from the substance or mixture
Carbon oxides

5.3 Advice for firefighters
Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information
No data available

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.
For personal protection see section 8.

6.2 Environmental precautions
Do not let product enter drains.

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.

6.4 Reference to other sections
For disposal see section 13.

SECTION 7: HANDLING AND STORAGE

7.1 Precautions for safe handling
Suitable extinguishing media
Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. Normal measures for preventive fire protection. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)
Apart from the uses mentioned in section 1.2 no other specific uses are stipulated.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters
Components with workplace control parameters
Contains no substances with occupational exposure limit values.

8.2 Exposure controls
Appropriate engineering controls
Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

8.3 Personal protective equipment
Eye/face protection
Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin 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. Wash and dry hands.

Body Protection
Impervious clothing recommended. The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection
For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure
Do not let product enter drains.
SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

1) Appearance
   Form: Solid
   Colour: Red/Orange Metal

2) Odour
   Odorless

3) Odour Threshold
   No data available

4) pH
   No data available

5) Melting point/freezing point
   No data available

6) Initial boiling point and boiling range
   No data available

7) Flash point
   Not applicable

8) Evaporation rate
   No data available

9) Flammability (solid, gas)
   No data available

10) Upper/lower flammability or explosive limits
    No data available

11) Vapour pressure
    No data available

12) Vapour density
    No data available

13) Relative density
    No data available

14) Water solubility
    No data available

15) Partition coefficient: n-octanol/water
    No data available

16) Auto-ignition temperature
    No data available

17) Decomposition temperature
    No data available

18) Viscosity
    No data available

19) Explosive properties
    No data available

20) Oxidizing properties
    No data available

9.2 Other safety information
   No data available

SECTION 10: STABILITY AND REACTIVITY

10.1 Reactivity
   No data available

10.2 Chemical stability
   Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions
   No data available

10.4 Conditions to avoid
   No data available
10.5 Incompatible materials
Strong oxidizing agents, Fluorine, Chlorine trifluoride, Strong acids

10.6 Hazardous decomposition products
Other decomposition products - No data available
In the event of fire: see section 5.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
No data available

Respiratory or skin sensitisation
No data available

Germ cell mutagenicity
No data available

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

Reproductive toxicity
No data available

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
No data available

Aspiration hazard
No data available

Additional Information
RTECS: No available
Symptoms of systemic copper poisoning may include: capillary damage, headache, cold sweat, weak pulse, and kidney and liver damage, central nervous system excitation followed by depression, jaundice, convulsions, paralysis, and coma. Death may occur from shock or renal failure. Chronic copper poisoning is typified by hepatic cirrhosis, brain damage and demyelination, kidney defects, and copper deposition in the cornea as exemplified by humans with Wilson's disease. It has also been reported that copper poisoning has lead to hemolytic
anemia and accelerates arteriosclerosis.

SECTION 12: ECOLOGICAL INFORMATION

12.1 Toxicity
See section 11.

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

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

SECTION 13: DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging
Dispose of as unused product.

SECTION 14: TRANSPORT INFORMATION

14.1 UN number

ADR/RID: -  
IMDG: -  
IATA: -

14.2 UN proper shipping name

ADR/RID: Not dangerous goods

IMDG: Not dangerous goods

IATA: Not dangerous goods

14.3 Transport hazard class(es)
14.4 Packaging group
ADR/RID: -  IMDG: -  IATA: -

14.5 Environmental hazards
ADR/RID: no  IMDG Marine pollutant: no  IATA: no

14.6 Special precaution for user
No data available

SECTION 15: REGULATORY INFORMATION

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture
No data available

15.2 Chemical Safety Assessment
For this product a chemical safety assessment was not carried out

SECTION 16: OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Eye Irrit.  Eye irritation
H319  Causes serious eye irritation.
H335  May cause respiratory irritation.
STOT SE  Specific target organ toxicity - single exposure

Full text of R-phrases referred to under sections 2 and 3

Xi  Irritant
R36/37  Irritating to eyes and respiratory system.

Further information

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