



SDS for ACS Material Graphene on Microporous Silicon Nitride TEM Membranes
Issue Date: November 1st 2016

Section 1: Product and Company Identification

Product Name: ACS Material Graphene on Silicon Nitride TEM Grids

Synonyms: Graphene, Graphene Sheets, Exfoliated Graphite, Silicon Nitride, SiNx.

Formula: C, Si, SiNx

Company Name: ACS Material, LLC

Company Address: 18 Vernon Street, Medford, MA 02155

Domestic Phone: 866-227-0656

International Phone:

Chemtrec Emergency Number: 1-800-424-9300 (24 hrs.)

Section 2: Composition Information on Ingredients

These products contain:

Component	CAS-No.	EC-No.	Approximate Wt. %
Silicon	7440-21-3	231-130-8	99.96
Silicon nitride	12033-89-5	234-796-8	0.03
Graphene	1034343-98-0	231-955-3	0.01

Physical Characteristics:

Appearance: Solid hexagonal disk with a greenish hue. The graphene film appears as a near-transparent to light-grey film on the surface of the microporous Silicon Nitride membrane.

Section 3: Hazard Identification

Emergency Overview:

These products are in solid form as received. The silicon nitride membrane is 200 nanometers in thickness and can be fractured if handled without due care, potentially releasing a small number of microscopic particles near the user that may act as an irritant. Whilst not the intended application of these products, if they are ground to a powder, the dust created in the process can be irritating.

Routes of Entry: Eyes, skin, ingestion and inhalation

Potential Health Effects:

Eyes: May cause eye irritation if placed in direct contact.

Skin: May cause skin irritation if placed in direct contact.

Ingestion: May be harmful, effects not known.

Inhalation: Unless ground to a powder or heated to a high temperature, exposure to the products by inhalation is not known to cause any deleterious health effects.

Accidental fracture of the membrane by the user could generate microscopic particles that may cause irritation to the upper respiratory tract.

Acute Health Hazards: No data available

Chronic Health Hazards:

Carcinogenic effects: No data available

Mutagenic effects: No data available

Teratogenic effects: No data available

Developmental toxicity: No data available

Medical Conditions Generally Aggravated by Exposure: Repeated or prolonged exposure is not known to aggravate any medical condition.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes. Seek medical attention if irritation continues.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Seek medical attention if irritation develops.

Serious Skin Contact: No data available

Inhalation: If inhaled, remove victim to fresh air. If breathing is difficult, give oxygen. If not breathing, administer artificial respiration. Seek medical attention.

Serious Inhalation: Evacuate victim to a safe area with fresh air as soon as possible. Loosen tight clothing such as collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion: DO NOT induce vomiting unless directed to do so by medical personnel. Loosen tight clothing such as collar, tie, belt or waistband. Seek medical attention.

Serious Ingestion: No data available

Section 5: Fire-Fighting Measures

Flash Point: Non-flammable

Flammable Limits in Air: Lower: N/A, Upper: N/A

Auto-Ignition Temperature: N/A

Extinguishing Media: Use carbon dioxide, dry chemical extinguishing agents, dry sand or dry ground dolomite.

Special Fire Fighting Procedures: No special fire-fighting procedures needed. Use normal procedures that include wearing NIOSH/MSHA-approved self-contained breathing apparatus, flame and chemical resistant clothing; hats, boots and gloves. If without risk, remove material from fire area.

Unusual Fire & Explosion Hazard: None known

Section 6: Accidental Release Measures

Overview: The use of personal protective equipment as outlined in Section 8 is recommended.

Spills/Leaks: Consult state, local or federal EPA regulations for proper disposal.

Section 7: Handling and Storage

Handling: These products need to be handled with the appropriate-sized tweezers to avoid direct contact with skin.

Storage: Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8: Exposure Controls and Personal Protection

Engineering Controls: None required if product is used as intended.

Ventilation: Laboratory fume hood

Respiratory Protection: Use a NIOSH/MSHA-approved dust respirator.

Eye Protection: Wear appropriate ANSI-approved safety goggles.

Skin Protection: Avoid direct contact with skin using tweezers.

Other Protective Clothing or Equipment: Use normal laboratory wear.

Section 9: Physical and Chemical Properties

Silicon

Physical state:	Solid
Appearance:	Silver-gray
Odor:	None
pH:	N/A
Vapor pressure:	1 mmHg at 1724 °C
Vapor density:	Unknown
Evaporation rate:	N/A
Viscosity:	N/A
Boiling point:	2355 °C
Melting point:	1410 °C
Decomposition temperature:	Not available
Solubility:	Insoluble in water
Density:	2.33 g/cm ⁻³
Molecular formula:	Si

Molecular weight: 28.085

Silicon Nitride

Physical state: Solid
Appearance: Green in color
Odor: None
pH: N/A
Vapor pressure: N/A
Vapor density: N/A
Evaporation rate: N/A
Viscosity: N/A
Boiling point: N/A - sublimes
Melting point: 1900 °C
Decomposition temperature: Not available
Solubility: Insoluble in water
Density: ~2.9 g/cm⁻³
Molecular formula: SiN
Molecular weight: 42.092

Graphene

Physical state: Solid
Appearance: Single layer is colorless, thicker layers are light grey in color
Odor: None
pH: N/A
Vapor pressure: N/A
Vapor density: N/A
Evaporation rate: N/A
Viscosity: N/A
Boiling point: N/A
Melting point: Sublimes between 3600 and 3700 °C
Solubility: Insoluble in water
Density: 2.09-2.23 g/cm⁻³
Molecular formula: C

Molecular weight:

12.01

Section 10: Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures

Conditions to Avoid: Incompatible materials, fracture of membrane, moisture, and excessive temperatures leading to sublimation and melting

Incompatibilities with Other Materials: Strong oxidizing agents

Hazardous Decomposition Products: Irritating, toxic fumes and gases based on oxides of silicon

Hazardous Polymerization: No information available

Section 11: Toxicological Information

When used as intended, these products are generally regarded as safe. A typical TLV (TWA) is 10mg/m³

CAS# 7440-21-3: Oral–rat: LD₅₀ = 3160 mg/kg. Draize test–rabbit, eye: 3mg: mild

Carcinogenicity: IARC Undefined

Epidemiology: IARC Undefined

Teratogenicity: No information available

Reproductive Effects: No information available

Neurotoxicity: No information available

Mutagenicity: No information available

Section 12: Ecological Information

Environmental: When used as intended as a TEM specimen support film, the disposal of these products is to be guided by any additional substances or materials with which the products have been in contact. If the products do not come into contact with additional substances or materials, they can be disposed of as inert materials. No adverse environmental impacts are known. The products are non-volatile, insoluble in water and will not biodegrade.

Section 13: Disposal Considerations

The product should be disposed of in a manner that is consistent with local, state and federal environmental control regulations.

Section 14: Transport Information

DOT Shipping Name: Not regulated
DOT Hazard Class: None
Product RQ: None
Technical shipping name: Metal alloy
UN or NA number: None

Section 15: Regulatory Information

United States of America

TSCA: CAS# 7440-21-3 is listed on the TSCA inventory. This material does not contain any Class 2 ozone depletors.

Clean Water Act: None of the chemicals in these products are listed as Hazardous Substances under the CWA. None of the chemicals in these products are listed as Priority Pollutants under the CWA. None of the chemicals in these products are listed as Toxic Pollutants under the CWA.

OSHA: None of the chemicals in these products is considered highly hazardous by OSHA.

HMIS (U.S.A.):

Health Hazard: 1
Fire Hazard: 0
Reactivity: 0
Personal Protection: E

National Fire Protection Association (U.S.A.):

Health Hazard: 1
Fire Hazard: 0
Reactivity: 0

Specific Hazard: No data available

Protective Equipment: Gloves, tweezers, lab coat, dust respirator and safety glasses

Federal and State Regulations:

California Director's List of Hazardous Substances: Silicon

Florida RTK: Silicon

Minnesota RTK: Silicon

European and International Regulations:

DSCL (EEC): These products are not classified per EU regulations. Not applicable.

EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

European Labeling in Accordance with EC Directives:

Hazard Symbols: Not available
Risk Phrases: Not available
Safety Phrases: WGK (Water Danger/Protection)
CAS# 7440-21-3: No information available

Canadian Regulations:

WHMIS (Canada): Not controlled under WHMIS (Canada)

CAS#s 7440-21-3 and 12033-89-5 are listed on Canada's DSL List.

CAS#s 7440-21-3 and 12033-89-5 are not listed on Canada's Ingredient Disclosure List.

Exposure Limits in Other Countries:

CAS# 7440-21-3:

OEL-Australia:	TWA 10 mg/m ³
OEL-Belgium:	TWA 10 mg/m ³
OEL-Denmark:	TWA 10 mg/m ³
OEL-France:	TWA 10 mg/m ³
OEL-Korea:	TWA 10mg/m ³
OEL-The Netherlands:	TWA 10 mg/m ³
OEL-Switzerland:	TWA 4 mg/m ³
OEL-United Kingdom:	TWA 10 mg/m ³ (total dust)
OEL-United Kingdom:	TWA 5 mg/m ³ (resp. dust)
OEL in Bulgaria, Columbia, Jordan, Korea:	Check with ACGIH TLV

OEL in New Zealand, Singapore, Vietnam:

Check with ACGI TLV

Section 16: Other Information

Disclaimer of Liability: These products and materials supplied by ACS Material, LLC, are not designed, warranted or certified for applications that involve implantation in the body; direct or indirect contact with the blood pathway; contact with bone, tissue, tissue fluid, or blood; or prolonged contact with mucous membranes.

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