Material Safety Data Sheet

ACS Material Monolayer Molybdenum Disulfide
(Powder and Dispersion)

Table of Contents

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1 – Product and Company Identification</td>
<td>9 – Physical and Chemical Properties</td>
</tr>
<tr>
<td>2 – Composition / Information on Ingredients</td>
<td>10 – Stability and Reactivity</td>
</tr>
<tr>
<td>3 – Hazards Identification</td>
<td>11 – Toxicological Information</td>
</tr>
<tr>
<td>4 – First Aid Measures</td>
<td>12 – Ecological Information</td>
</tr>
<tr>
<td>5 – Firefighting Measures</td>
<td>13 – Disposal Considerations</td>
</tr>
<tr>
<td>6 – Accidental Release Measures</td>
<td>14 – Transport Information</td>
</tr>
<tr>
<td>7 – Handling and Storage</td>
<td>15 – Regulatory Information</td>
</tr>
<tr>
<td>8 – Exposure Controls, Personal Protection</td>
<td>16 – Other Information</td>
</tr>
</tbody>
</table>
1. Product and Company Identification

Product Name: ACS Material Monolayer Molybdenum Disulfide

Synonyms: Molybdenum Disulfide, MoS₂

CAS NO.: 1317-33-5

Contacting Information:

Manufacturer: ACS Material, LLC.
Address: 18 Vernon Street, Medford, MA 02155
Phone: (866)-227-0656
Fax: (781)-518-0284
E-Mail: contact@acsmaterial.com

2. Composition/Information on Ingredients

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>CAS No</th>
<th>Monolayer ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoS₂</td>
<td>1317-33-5</td>
<td>&gt;95%</td>
</tr>
</tbody>
</table>

3. Hazards Identification

EMERGENCY OVERVIEW

Appearance: black powder

Caution! May cause mechanical eye and skin irritation. May cause respiratory tract irritation. May cause lung damage. May cause central nervous system effects.

Target Organs: Lungs.

POTENTIAL HEALTH EFFECTS

Eye: Dust may cause mechanical irritation. May cause lacrimation (tearing), blurred vision, and photophobia. May cause chemical conjunctivitis and corneal damage.

Skin: Dust causes mechanical irritation.

Ingestion: May cause nausea, vomiting, abdominal pain, and increased salivation.

Inhalation: May cause lung damage. Olfactory fatigue may occur. Can produce delayed pulmonary edema. Inhalation of dusts cause severe irritation of the upper respiratory tract, gastrointestinal disturbances, albuminuria, gradual loss of weight, and increasing weakness.

Chronic: Chronic inhalation may lead to decreased pulmonary function.
4. First Aid Measures

**Eyes:** Flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

**Skin:** Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid if irritation develops or persists. Wash clothing before reuse.

**Ingestion:** Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.

**Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

**Notes to Physician:** Treat symptomatically and supportively.

5. Fire Fighting Measures

**General Information:** As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion. Will burn if involved in a fire.

**Extinguishing Media:** For large fires, use water spray, fog or regular foam. For small fires, use dry chemical, carbon dioxide, sand, earth, water spray or regular foam. Cool containers with flooding quantities of water until well after fire is out.

**Flash Point:** Not applicable.

**Autoignition Temperature:** Not available.

**Explosion Limits, Lower:** Not available.

**Upper:** Not available.

**NFPA Rating:** (estimated) Health: 1; Flammability: 3; Instability: 0; Personal Protection: E.

6. Accidental Release Measures

**General Information:** Use proper personal protective equipment as indicated in Section 8. Spills/Leaks: Vacuum or sweep up material and place into a suitable disposal container. Scoop up with a nonsparking tool, then place into a suitable container for disposal. Avoid generating dusty conditions. Remove all sources of ignition.

7. Handling and Storage

**Handling:** Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Avoid ingestion and inhalation. Activated Carbon, especially when wet, can deplete oxygen from air in enclosed spaces, and dangerously low levels of oxygen may result.
**Storage:** Store in a tightly closed container. Keep from contact with oxidizing materials. Store in a cool, dry, well-ventilated area away from incompatible substances.

**8. Exposure Controls, Personal Protection**

**Engineering Controls:** Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local explosion-proof ventilation to keep airborne levels to acceptable levels.

**OSHA Vacated PELs:** Charcoal, activated: No OSHA Vacated PELs are listed for this chemical.

**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.

**Skin:** Wear appropriate gloves to prevent skin exposure.

**Clothing:** Wear appropriate protective clothing to minimize contact with skin.

**Respirators:** Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

**9. Physical and Chemical Properties**

**Physical State:** powder

**Appearance:** black

**Odor:** odorless

**pH:** Not available.

**Vapor Pressure:** Not available

**Vapor Density:** Not available.

**Evaporation Rate:** Negligible.

**Viscosity:** Not available.

**Boiling Point:** Not available.

**Freezing/Melting Point:** 2375 °C

**Decomposition Temperature:** Not available.

**Solubility:** insoluble in water.

**Specific Gravity/Density:** 5.06 g/cm3 at 25 °C

**Molecular Formula:** MoS2

**Molecular Weight:** 160.07
10. Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures.
Conditions to Avoid: No data available.
Hazardous Decomposition Products: Hazardous decomposition products formed under fire conditions. - Sulphur oxides, Molybdenum oxides
Other decomposition products - No data available.
Hazardous Polymerization: Has not been reported.
Materials to avoid: Hydrogen peroxide, Strong oxidizing agents.

11. Toxicological Information

RTECS#: 
CAS# 1317-33-5
LD50/LC50: 
Not available.
Carcinogenicity: 
CAS# 1317-33-5: Not listed by ACGIH, IARC, NTP, or CA Prop 65.
Epidemiology: No information found
Teratogenicity: No information found
Reproductive Effects: No information found
Mutagenicity: No information found
Neurotoxicity: No information found
Other Studies:
Toxicological information on Molybdenum Disulfide may be found at the website of the International Council on Nanotechnology at http://icon.rice.edu/

12. Ecological Information

Ecotoxicity: Not available.
BOD5 and COD: Not available.

13. Disposal Considerations

Waste Disposal:
Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste.
US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.
RCRA P-Series: None listed.
RCRA U-Series: None listed.
14. Transport Information
Not regulated.

15. Regulatory Information

US FEDERAL

TSCA
   CAS# 1317-33-5 is listed on the TSCA inventory.
Health & Safety Reporting List
   None of the chemicals are on the Health & Safety Reporting List.
Chemical Test Rules
   None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
   None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
   None of the chemicals in this material have a SNUR under TSCA.
CERCLA Hazardous Substances and corresponding RQs
   None of the chemicals in this material have an RQ.
SARA Section 302 Extremely Hazardous Substances
   None of the chemicals in this product have a TPQ.
SARA Codes
   CAS # 1317-33-5: immediate.
Section 313 No chemicals are reportable under Section 313.
Clean Air Act:
   This material does not contain any hazardous air pollutants.
   This material does not contain any Class 1 Ozone depletors.
   This material does not contain any Class 2 Ozone depletors.
Clean Water Act:
   None of the chemicals in this product are listed as Hazardous Substances under the CWA.
   None of the chemicals in this product are listed as Priority Pollutants under the CWA.
   None of the chemicals in this product are listed as Toxic Pollutants under the CWA.
OSHA:
   None of the chemicals in this product are considered highly hazardous by OSHA.
STATE
   CAS# 1317-33-5 is not present on state lists from CA, PA, MN, MA, FL, or NJ.
California Prop 65
California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations
European Labeling in Accordance with EC Directives
Hazard Symbols:
  Not available.
Risk Phrases:
Safety Phrases:
  S 24/25 Avoid contact with skin and eyes.
WGK (Water Danger/Protection)
  CAS# 1317-33-5 : 0

Canada - DSL/NDSL
  CAS# 1317-33-5 is listed on Canada's DSL List.
Canada - WHMIS
  This product has a WHMIS classification of B6, D2B.
This product has been classified in accordance with the hazard criteria of the Controlled Products
Regulations and the MSDS contains all of the information required by those regulations.
Canadian Ingredient Disclosure List

16. Other Information

Label Precautions: Avoid contact with eyes, skin and clothing. Wash thoroughly after handling. Avoid breathing dust or vapors. Keep container closed. Use only with adequate ventilation.

Label First Aid: If swallowed, induce vomiting immediately as directed by medical personnel. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In case of contact, immediately flush eyes or skin with plenty of water for at least 15 minutes. Remove contaminated clothing and shoes. Wash clothing before reuse. In all cases, seek medical attention.

Product Use: Laboratory Reagent.

Disclaimer: ACS Material LLC. believes that the information in this Material Safety Data Sheet is accurate and represents the best and most current information available to us. ACS Material makes no representations or warranties either express or implied, regarding the suitability of the material for any purpose or the accuracy of the information contained within this document. Accordingly, ACS Material will not be responsible for damages resulting from use of or reliance upon this information.