SECTION 1: IDENTIFICATION OF THE PRODUCT AND OF THE COMPANY

1.1 Product identifiers

Product Name: ACS Material Monolayer MoS$_2$ Film on SiO$_2$
Brand: ACS Material LLC
CAS-No.: 1317-33-5 (MoS$_2$); 60676-86-0 (SiO$_2$)

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

Identified uses: Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company: ACS MATERIAL LLC
959 E Walnut St., 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

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

None.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Substance name: ACS Material Monolayer MoS$_2$ Film on SiO$_2$
CAS-No: 1317-33-5
EC-No: 215-263-9
Synonyms: Molybdenum disulfide film, MoS$_2$ nanoplates
Molecular weight : 160.07 g/mol
Linear formula : MoS₂

CAS-No : 60676-86-0
Synonyms : Silica
Quartz
Sand
Cristobalite

Molecular weight : 60.08 g/mol
Linear formula : SiO₂

Hazardous ingredients
Chemical characterization: Molybdenum Disulfide, crystalline, synthetic, non fibrous

<table>
<thead>
<tr>
<th>Components</th>
<th>Concentration</th>
<th>CAS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>MoS₂</td>
<td>&lt;=100%</td>
<td>1317-33-5</td>
</tr>
</tbody>
</table>

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
Wash off with soap and plenty of water. Consult a physician.

In case of eye contact
Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed
Do NOT induce vomiting. 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
SECTION 5: FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media
Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide. Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

5.2 Special hazards arising from the substance or mixture
Silicon 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
Avoid dust formation. Avoid breathing vapours, mist or gas.

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
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
Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
Store in cool place. 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

<table>
<thead>
<tr>
<th>Components</th>
<th>CAS-No.</th>
<th>Value</th>
<th>Control Parameters</th>
<th>Basis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molybdenum(V) sulfide</td>
<td>1317-33-5</td>
<td>TWA</td>
<td>15.000000 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>10.000000 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>3.000000 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>15 mg/m³</td>
<td>USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>10 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA</td>
<td>3 mg/m³</td>
<td>USA. ACGIH Threshold Limit Values (TLV)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PEL</td>
<td>10 mg/m³</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PEL</td>
<td>3 mg/m³</td>
<td>California permissible exposure limits for chemical contaminants (Title 8, Article 107)</td>
</tr>
</tbody>
</table>

8.2 Exposure controls
Appropriate engineering controls
General industrial hygiene practice.

8.3 Personal protective equipment
Eye/face protection
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.
The selected protective gloves have to satisfy the specifications of EU Directive 89/686/EEC and the standard EN 374 derived from it.

**Body Protection**
Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place. Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

**Respiratory protection**
Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. 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.

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**SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES**

### 9.1 Information on basic physical and chemical properties

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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</thead>
<tbody>
<tr>
<td>1)</td>
<td>Appearance</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>2)</td>
<td>Odour</td>
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<tr>
<td>3)</td>
<td>Odour Threshold</td>
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<tr>
<td>4)</td>
<td>pH</td>
</tr>
<tr>
<td>5)</td>
<td>Melting point/freezing point</td>
</tr>
<tr>
<td>6)</td>
<td>Initial boiling point and boiling range</td>
</tr>
<tr>
<td>7)</td>
<td>Flash point</td>
</tr>
<tr>
<td>8)</td>
<td>Evaporation rate</td>
</tr>
<tr>
<td>9)</td>
<td>Flammability (solid, gas)</td>
</tr>
<tr>
<td>10)</td>
<td>Upper/lower flammability or explosive limits</td>
</tr>
<tr>
<td>11)</td>
<td>Vapour pressure</td>
</tr>
<tr>
<td>12)</td>
<td>Vapour density</td>
</tr>
<tr>
<td>13)</td>
<td>Relative density</td>
</tr>
<tr>
<td>14)</td>
<td>Water solubility</td>
</tr>
<tr>
<td>15)</td>
<td>Partition coefficient: n- octanol/water</td>
</tr>
<tr>
<td>16)</td>
<td>Auto-ignition temperature</td>
</tr>
<tr>
<td>17)</td>
<td>Decomposition temperature</td>
</tr>
<tr>
<td>18)</td>
<td>Viscosity</td>
</tr>
</tbody>
</table>
9.2 Other safety information
Bulk density(SiO₂): 480 - 600 kg/m³

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
Heat, flames, sparks, exposed to solarization and rain.

10.5 Incompatible materials
Hydrogen peroxide, oxidizing agents, strong oxidizing agents.

10.6 Hazardous decomposition products
Other decomposition products - No data available.
Hazardous decomposition products formed under fire conditions. - Sulphur oxides, Molybdenum oxides.
In the event of fire: see section 5.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity
MoS₂:
LC50 Inhalation: > 2,820 mg/m³ (Rat 4 h)
Remarks: Lungs, Thorax, or Respiration: Other changes.
Dermal: No data available.
No data available.

SiO₂:
LD50 Oral - rat - > 5,000 mg/kg
Inhalation: no data available
Dermal: no data available

Skin corrosion/irritation
No data available.

Serious eye damage/eye irritation
Safety Data Sheet – Monolayer MoS$_2$ on SiO$_2$  
ACS Material LLC

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.

ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

**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: QA4697000
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

**SECTION 12: ECOLOGICAL INFORMATION**

12.1 **Toxicity**
No data available.

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

**UN number**
ADR/RID: - IMDG: - IATA: -

**UN proper shipping name**
ADR/RID: Not dangerous goods
IMDG: Not dangerous goods
IATA: Not dangerous goods

**Transport hazard class(es)**
ADR/RID: - IMDG: - IATA: -

**Packaging group**
ADR/RID: - IMDG: - IATA: -

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

**Special precautions for user**
No data available.

SECTION 15: REGULATORY INFORMATION

15.1 **Safety, health and environmental regulations/legislation specific for the substance or mixture**

**Authorisations and/or restrictions on use**

**SARA 302 Components**
No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 313 Components
This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards
No SARA Hazards.

Massachusetts Right To Know Components
- Molybdenum(IV) sulfide 1317-33-5 1993-04-24

Pennsylvania Right To Know Components
- Molybdenum(IV) sulfide 1317-33-5 1993-04-24
- Silicon dioxide -

New Jersey Right To Know Components
- Molybdenum(IV) sulfide 1317-33-5 1993-04-24
- Silicon dioxide -

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

SECTION 16: OTHER INFORMATION

HMIS Classification
Health hazard: 0
Chronic Health Hazard: 0
Flammability: 0
Physical Hazard: 0

NFPA Rating
Health hazard: 0
Fire Hazard: 0
Reactivity Hazard: 0

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