SAFETY DATA SHEET
Molybdenum Solid Metal

Section 1. Identification

<table>
<thead>
<tr>
<th>GHS product identifier</th>
<th>Molybdenum Solid Metal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Other means of identification</td>
<td>Not available.</td>
</tr>
<tr>
<td>Product type</td>
<td>Massive metal.</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Material uses</th>
</tr>
</thead>
<tbody>
<tr>
<td>Electrical Industry and Electronics.</td>
</tr>
<tr>
<td>Mechanical Engineering.</td>
</tr>
<tr>
<td>Optical Industry.</td>
</tr>
<tr>
<td>Metal-working Industry.</td>
</tr>
</tbody>
</table>

Manufacturer

<table>
<thead>
<tr>
<th>H.C. Starck Inc.</th>
</tr>
</thead>
<tbody>
<tr>
<td>45 Industrial Place</td>
</tr>
<tr>
<td>Newton, MA 02461, USA</td>
</tr>
<tr>
<td>Telephone: 617-630-5800</td>
</tr>
</tbody>
</table>

Emergency telephone number (with hours of operation)

| GENERAL INFORMATION - +617-584-4569 [8:00 a.m - 6:00 p.m EST] |
| CHEMTREC (US, Transportation) - 800-424-9300 [24h] |
| CHEMTREC (International, Transportation) - +703-527-3887 [24h] |

e-mail address of person responsible for this SDS

| msdsus@hcstarck.com |

Section 2. Hazards identification

<table>
<thead>
<tr>
<th>OSHA/HCS status</th>
</tr>
</thead>
<tbody>
<tr>
<td>While this material is not considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200), this SDS contains valuable information critical to the safe handling and proper use of the product. This SDS should be retained and available for employees and other users of this product.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Classification of the substance or mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not classified.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>GHS label elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Signal word</td>
</tr>
<tr>
<td>Hazard statements</td>
</tr>
</tbody>
</table>

Precautionary statements

<table>
<thead>
<tr>
<th>Prevention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Storage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disposal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not applicable.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Hazards not otherwise classified</th>
</tr>
</thead>
<tbody>
<tr>
<td>Handling and/or processing of this material may generate a dust which can cause mechanical irritation of the eyes, skin, nose and throat. Under normal conditions of use this product is non-hazardous. However, if this product is ground or otherwise processed those ingredients mentioned in Section 3 could be generated.</td>
</tr>
</tbody>
</table>

Section 3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Substance/mixture</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other means of identification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not available.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAS number/other identifiers</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAS number</td>
</tr>
</tbody>
</table>

Date of issue/Date of revision: 8/6/2013
Date of previous issue: No previous validation.
Version: 1
Section 3. Composition/information on ingredients

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>%</th>
<th>CAS number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molybdenum</td>
<td>99.95 - 99.97</td>
<td>7439-98-7</td>
</tr>
</tbody>
</table>

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact: Get medical attention if any damage to the eye is caused by the metal.
Inhalation: Not applicable.
Skin contact: Flush contaminated skin with plenty of water. Cuts should be treated promptly and covered.
Ingestion: Not applicable.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact: Not applicable.
Inhalation: Not applicable.
Skin contact: No known significant effects or critical hazards.
Ingestion: Not applicable.

Over-exposure signs/symptoms

Eye contact: No specific data.
Inhalation: No specific data.
Skin contact: No specific data.
Ingestion: No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician: Treat symptomatically.
Specific treatments: No specific treatment.
Protection of first-aiders: No action shall be taken involving any personal risk or without suitable training.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

Suitable extinguishing media: Dry powder type agents specially designed for metal powder fires.

Unsuitable extinguishing media: Do not use water jet. Carbon dioxide (CO₂).

Specific hazards arising from the chemical

Dust and Fumes from this product may be a fire and explosion hazard when exposed to high temperatures or ignition sources. Particle size and dispersion in air determine reactivity.

Hazardous thermal decomposition products: Decomposition products may include the following materials: metal oxide/oxides, Molybdenum trioxide.
Section 5. Fire-fighting measures

Special protective actions for fire-fighters: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training.

Special protective equipment for fire-fighters: No special protection is required.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures

For non-emergency personnel: No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Put on appropriate personal protective equipment.

For emergency responders: If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

Environmental precautions: No specific hazard.

Methods and materials for containment and cleaning up

Small spill: Restack safely. Take care with items that are sharp or heavy.

Large spill: Restack safely. Take care with items that are sharp or heavy. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures: Put on appropriate personal protective equipment (see Section 8). Take care with items that are sharp or heavy.

Advice on general occupational hygiene: Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities: Store in accordance with local regulations.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

<table>
<thead>
<tr>
<th>Ingredient name</th>
<th>Exposure limits</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moaybdenum</td>
<td>ACGIH TLV (United States, 3/2012). TWA: 10 mg/m³, (as Mo) 8 hours. Form: Inhalable fraction TWA: 3 mg/m³, (as Mo) 8 hours. Form: Respirable fraction</td>
</tr>
</tbody>
</table>

Appropriate engineering controls: No special ventilation requirements.

Environmental exposure controls: Not applicable.

Individual protection measures

Hygiene measures: Wash thoroughly after handling.
Section 8. Exposure controls/personal protection

Eye/face protection: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection
- Hand protection: Use strong, cut-resistant gloves suitable for handling metals.
- Body protection: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Other skin protection: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory protection: Not applicable.

Section 9. Physical and chemical properties

Appearance
- Physical state: Solid.
- Bar. / Billet. / Billet. / Coils. / Disc. / Foil. / Glass Melting Electrode. / Pellets. / Plate. / Rod. / Scrap. / Sheet. / Sputtering Targets. / Tube. / Wire.

Color: Gray.
Odor: Odorless.
Odor threshold: Not available.

pH: Not applicable.
Melting point: 2620°C (4748°F)
Boiling point: Not available.
Flash point: Not available.
Burning time: Not available.
Burning rate: Not available.
Evaporation rate: Not applicable.
Flammability (solid, gas): Not available.
Lower and upper explosive (flammable) limits: Not applicable.
Vapor pressure: Not applicable.
Vapor density: Not applicable.
Relative density: 10.2
Solubility: Not available.
Solubility in water: Not available.
Partition coefficient: n-octanol/water: Not available.
Auto-ignition temperature: Not applicable.
Decomposition temperature: Not available.
SADT: Not applicable.
Viscosity: Not applicable.

Section 10. Stability and reactivity

Reactivity: No specific test data related to reactivity available for this product or its ingredients.

Chemical stability: The product is stable.

Possibility of hazardous reactions: Under normal conditions of storage and use, hazardous reactions will not occur.
Section 10. Stability and reactivity

Conditions to avoid: Avoid the creation of dust when handling and avoid all possible sources of ignition (spark or flame). Prevent dust accumulation.

Incompatible materials: Evolves hydrogen on contact with acids. Risk of formation of explosive hydrogen-air mixtures.

Hazardous decomposition products: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity
Not available.

Irritation/Corrosion
Not available.

Sensitization
Not available.

Mutagenicity
Not available.

Carcinogenicity
Not available.

Reproductive toxicity
Not available.

Teratogenicity
Not available.

Specific target organ toxicity (single exposure)

<table>
<thead>
<tr>
<th>Name</th>
<th>Category</th>
<th>Route of exposure</th>
<th>Target organs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molybdenum</td>
<td>Category 3</td>
<td>Not applicable.</td>
<td>Respiratory tract irritation</td>
</tr>
</tbody>
</table>

Specific target organ toxicity (repeated exposure)
Not available.

Aspiration hazard
Not available.

Information on the likely routes of exposure: Routes of entry anticipated: Oral, Dermal, Inhalation.

Potential acute health effects

Eye contact: Not applicable.
Inhalation: Not applicable.
Skin contact: No known significant effects or critical hazards.
Ingestion: Not applicable.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact: No specific data.
Inhalation: No specific data.
Section 11. Toxicological information

Skin contact: No specific data.
Ingestion: No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure
- Potential immediate effects: Not available.
- Potential delayed effects: Not available.

Long term exposure
- Potential immediate effects: Not available.
- Potential delayed effects: Not available.

Potential chronic health effects
Not available.

General: No known significant effects or critical hazards.
Carcinogenicity: No known significant effects or critical hazards.
Mutagenicity: No known significant effects or critical hazards.
Teratogenicity: No known significant effects or critical hazards.
Developmental effects: No known significant effects or critical hazards.
Fertility effects: No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates
Not available.

Section 12. Ecological information

Toxicity

<table>
<thead>
<tr>
<th>Product/ingredient name</th>
<th>Result</th>
<th>Species</th>
<th>Exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molybdenum</td>
<td>Acute LC50 200000 μg/l</td>
<td>Daphnia - Daphnia magna</td>
<td>48 hours</td>
</tr>
<tr>
<td></td>
<td>Acute LC50 800 mg/l Fresh water</td>
<td>Fish - Oncorhynchus mykiss</td>
<td>96 hours</td>
</tr>
<tr>
<td></td>
<td>Chronic NOEC 500 mg/l Marine water</td>
<td>Algae - Glenodinium halli</td>
<td>72 hours</td>
</tr>
</tbody>
</table>

Persistence and degradability
Not available.

Bioaccumulative potential
Not available.

Mobility in soil
- Soil/water partition coefficient (Koc): Not available.

Other adverse effects: No known significant effects or critical hazards.
Section 13. Disposal considerations

Disposal methods: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues.

Section 14. Transport information

<table>
<thead>
<tr>
<th>DOT Classification</th>
<th>TDG Classification</th>
<th>Mexico Classification</th>
<th>ADR/RID</th>
<th>IMDG</th>
<th>IATA</th>
</tr>
</thead>
<tbody>
<tr>
<td>UN proper shipping name</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Transport hazard class(es)</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Packing group</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Additional information</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Special precautions for user: Transport within user's premises: always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code: Not available.

Section 15. Regulatory information

U.S. Federal regulations: United States inventory (TSCA 8b): All components are listed or exempted.

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs): Not listed
Clean Air Act Section 602 Class I Substances: Not listed
Clean Air Act Section 602 Class II Substances: Not listed
DEA List I Chemicals (Precursor Chemicals): Not listed
DEA List II Chemicals (Essential Chemicals): Not listed
SARA 302/304 Composition/information on ingredients: No products were found.
Section 15. Regulatory information

<table>
<thead>
<tr>
<th>Name</th>
<th>%</th>
<th>Fire hazard</th>
<th>Sudden release of pressure</th>
<th>Reactive</th>
<th>Immediate (acute) health hazard</th>
<th>Delayed (chronic) health hazard</th>
</tr>
</thead>
</table>

State regulations

Massachusetts: The following components are listed: MOLYBDENUM

New York: None of the components are listed.

New Jersey: The following components are listed: MOLYBDENUM

Pennsylvania: The following components are listed: MOLYBDENUM

California Prop. 65

The California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) requires that the Governor of California publish a list of chemicals known to the State to cause cancer or reproductive harm. No Proposition 65 chemicals are intentionally added to this product; however, components used in the manufacture of this product may contain minor trace amounts of inherent naturally occurring elements (such as, but not limited to, arsenic, beryllium, cadmium, cobalt, lead, mercury, nickel, and radionuclides) that are on the Governor’s Proposition 65 list.

Canada inventory: All components are listed or exempted.

International regulations

International lists:
- Australia inventory (AICS): All components are listed or exempted.
- China inventory (IECSC): All components are listed or exempted.
- Japan inventory: All components are listed or exempted.
- Korea inventory: All components are listed or exempted.
- Malaysia Inventory (EHS Register): Not determined.
- New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.
- Philippines inventory (PICCS): All components are listed or exempted.
- Taiwan inventory (CSNN): All components are listed or exempted.

Chemical Weapons Convention List Schedule
- I Chemicals: Not listed
- II Chemicals: Not listed
- III Chemicals: Not listed

Section 16. Other information

Hazardous Material Information System (U.S.A.)

Health: 0
Flammability: 0
Physical hazards: 0

Date of issue/Date of revision: 6/6/2013
Date of previous issue: No previous validation
Version: 1
Section 16. Other information

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

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

Flammability
Health
Instability/Reactivity
Special

Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

History
Date of printing : 8/6/2013.
Date of issue/Date of revision : 8/6/2013.
Date of previous issue : No previous validation.
Version : 1
Key to abbreviations : ATE = Acute Toxicity Estimate
BCF = Bioconcentration Factor
GHS = Globally Harmonized System of Classification and Labelling of Chemicals
IATA = International Air Transport Association
IBC = Intermediate Bulk Container
IMDG = International Maritime Dangerous Goods
LogPow = logarithm of the octanol/water partition coefficient
UN = United Nations

References : Not available.

Indicates information that has changed from previously issued version.

Notice to reader

The information is furnished without warranty, expressed or implied, except that it is accurate to the best knowledge of H.C. Starck Inc. The data on this sheet relates only to the specific material designated herein. The data is not a quality specification. Neither H.C. Starck Inc. nor its affiliates assumes legal responsibility for use of or reliance on this information. Suitably of use of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, H.C. Starck Inc. cannot guarantee that these are the only hazards that exist.

Date of issue/Date of revision : 8/6/2013. Date of previous issue : No previous validation. Version : 1