SAFETY DATA SHEET

Molybdenum metal pieces

1. PRODUCT AND COMPANY IDENTIFICATION

PRODUCT NAME: Molybdenum metal pieces
GENERAL USE: Physical vapor deposition of thin films

MANUFACTURER
Kurt J Lesker Company
United States
1925 Route 51
Jefferson Hills, PA 15025
Customer Service: 412-387-9200
E-Mail: msds@lesker.com
Kurt J Lesker Company LTD
United Kingdom
15-16 Burgess Road
Hastings, East Sussex, TN35 4NR
England
Customer Service: +44 (0) 1424 458100

24 HR. EMERGENCY TELEPHONE NUMBERS
24-Hour Emergency Response provided by 3E Global Incident Response Hotline
When calling, refer to Kurt J Lesker Company
Global Response Access Code: 333594
North America [USA, Canada, Mexico]: 1-866-519-4752
Mainland China: (+) -86- 4001 2001 74
Europe: (+)-1-760-476-3961
Asia Pacific: {+}-1-760-476-3960
Middle East & Africa: {+}-1-760-476-3959

2. HAZARDS IDENTIFICATION

GHS CLASSIFICATIONS
Health:
This substance or mixture is not hazardous and is not classified under GHS.

EMERGENCY OVERVIEW

PHYSICAL APPEARANCE: Grey metal

IMMEDIATE CONCERNS: Negligible fire or explosion hazard in bulk form. Powdered material may form explosive dust-air mixtures.

POTENTIAL HEALTH EFFECTS

EYES: Contact may cause eye irritation.
SKIN: May cause skin irritation.
INGESTION: May be harmful if swallowed.
INHALATION: May be harmful if inhaled. May cause respiratory irritation.

REPRODUCTIVE TOXICITY

REPRODUCTIVE EFFECTS: Not Available
TERATOGENIC EFFECTS: Not Available
CARCINOGENICITY: Not listed as a human carcinogen
MUTAGENICITY: Not Available

ROUTES OF ENTRY: Ingestion, Inhalation
IRRITANCY: May cause irritation of skin, eyes, and respiratory tract.
PHYSICAL HAZARDS: This substance is not considered hazardous in the form supplied. Dusts at sufficient concentrations can form explosive mixtures with air.

### 3. COMPOSITION / INFORMATION ON INGREDIENTS

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Wt.%</th>
<th>CAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molybdenum</td>
<td>100</td>
<td>7439-98-7</td>
</tr>
</tbody>
</table>

### 4. FIRST AID MEASURES

**EYES:** Immediately flush eyes with plenty of water. Get medical attention, if irritation persists.

**SKIN:** Wash with soap and water. Get medical attention if irritation develops or persists.

**INGESTION:** Rinse mouth. Get medical advice/attention.

**INHALATION:** Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

**SIGNS AND SYMPTOMS OF OVEREXPOSURE**

**CHRONIC EFFECTS:** Not Available

### 5. FIRE FIGHTING MEASURES

**FLAMMABLE CLASS:** Noncombustible except as a powder.

**EXTINGUISHING MEDIA:** Use a Class D dry powder extinguisher, dolomite, dry sand, graphite, or soda ash.

**EXPLOSION HAZARDS:** Dusts at sufficient concentrations can form explosive mixtures with air.

**FIRE FIGHTING PROCEDURES:** As in any fire, wear self-contained breathing apparatus pressure-demand, (MSHA/NIOSH approved or equivalent) and full protective gear.

**HAZARDOUS DECOMPOSITION PRODUCTS:** Toxic metal fumes

### 6. ACCIDENTAL RELEASE MEASURES

**SMALL SPILL:** Clean up spills immediately, observing precautions in Protective Equipment section.

**LARGE SPILL:** Collect spilled material in appropriate container. Spill may be reportable. Consult section 15 for Reportable Quantities.

**GENERAL PROCEDURES:** Isolate hazard area. Keep unnecessary and unprotected personnel from entering. Eliminate all ignition sources if safe to do so. Avoid formation of dust. Provide appropriate exhaust ventilation where dust is formed. Avoid breathing (dust, vapor, mist, gas). Practice good chemical hygiene during and after use. Avoid release to the environment.

### 7. HANDLING AND STORAGE

**GENERAL PROCEDURES:** To avoid risks to human health and the environment, comply with the instructions for use.

**HANDLING:** Keep away from heat and flame. Keep container closed when not in use. Remove contaminated clothing and wash before reuse. Wash hands before eating and wash before reuse. Wash thoroughly after handling.

**STORAGE:** Keep container closed when not in use. Store in a cool dry place.
8. EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

EYES AND FACE: Wear safety glasses.

SKIN: Wear protective gloves.

RESPIRATORY: If ventilation is inadequate and this material is handled at elevated temperatures or dusts/fumes/mists are generated a NIOSH/MSHA approved air purifying respirator with a manufacturer approved cartridge or canister may be permissible under certain circumstances where airborne concentrations are expected to exceed exposure limits. Protection provided by air purifying respirators is limited. Use a positive pressure air supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

WORK HYGIENIC PRACTICES: Practice good chemical hygiene during and after use.

COMMENTS:

<table>
<thead>
<tr>
<th>Component</th>
<th>Location, Type</th>
<th>Value (mg/m³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Molybdenum</td>
<td>ACGIH TLV TWA (Respirable)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>OSHA OEL TWA (Total)</td>
<td>15</td>
</tr>
<tr>
<td></td>
<td>Canada - AB, BC, ON TWA (Respirable)</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Canada - PQ</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Europe TWA</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Poland TWA (Respirable)</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Poland STEL (Respirable)</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Spain TWA (Respirable)</td>
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</tr>
<tr>
<td></td>
<td>Sweden TWA (Respirable)</td>
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</tr>
<tr>
<td></td>
<td>Australia, NZ, Singapore TWA</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>UK WEL TWA</td>
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</tr>
<tr>
<td></td>
<td>UK WEL STEL</td>
<td>20</td>
</tr>
</tbody>
</table>

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Solid

ODOR: None

COLOR: Lustrous grey

pH: NA = Not Applicable

PERCENT VOLATILE: NA = Not Applicable

FLASH POINT AND METHOD: NA = Not Applicable

FLAMMABLE LIMITS: NA = Not Applicable

AUTOIGNITION TEMPERATURE: Not Available

VAPOR PRESSURE: NA = Not Applicable

VAPOR DENSITY: NA = Not Applicable
BOILING POINT: 4639°C
MELTING POINT: 2523°C
SOLUBILITY IN WATER: Insoluble
DENSITY: 10.28 at 25°C
MOLECULAR WEIGHT: 95.96

10. STABILITY AND REACTIVITY
STABLE: Yes
HAZARDOUS POLYMERIZATION: No
HAZARDOUS DECOMPOSITION PRODUCTS: Toxic metal fumes
INCOMPATIBLE MATERIALS: Strong acids, Oxidizing materials, Halogens.

11. TOXICOLOGICAL INFORMATION
ACUTE
DERMAL LD₅₀: Not Available
SKIN ABSORPTION: Not Available
ORAL LD₅₀: Not Available
INHALATION LC₅₀: Not Available
CARCINOGENICITY
IARC: Not listed
NTP: Not listed
OSHA: Not listed
REPRODUCTIVE EFFECTS: Not Available
TERATOGENIC EFFECTS: Not Available
MUTAGENICITY: Not Available

12. ECOLOGICAL INFORMATION
BIOACCUMULATION/ACCUMULATION: Not Available
AQUATIC TOXICITY (ACUTE)
96-HOUR LC₅₀: 800 mg/L (Onchorhyncus mykiss)
CHEMICAL FATE INFORMATION: Not Available

13. DISPOSAL CONSIDERATIONS
DISPOSAL METHOD: Dispose of according to applicable federal, state, provincial, and local regulations.
PRODUCT DISPOSAL: Contact a licensed waste disposal company.
EMPTY CONTAINER: Follow all MSDS/label precautions even after container is emptied because it may retain product residues.
14. TRANSPORT INFORMATION

DOT (DEPARTMENT OF TRANSPORTATION)

PROPER SHIPPING NAME: Not Regulated

ROAD AND RAIL (ADR/RID)

PROPER SHIPPING NAME: Not Regulated

AIR (ICAO/IATA)

SHIPPING NAME: Not Regulated

VESSEL (IMO/IMDG)

SHIPPING NAME: Not Regulated

CANADA TRANSPORT OF DANGEROUS GOODS

SHIPPING NAME: Not Regulated

15. REGULATORY INFORMATION

UNITED STATES

TSCA (TOXIC SUBSTANCE CONTROL ACT)

TSCA STATUS: All components of this product are included in inventory, exempt, or notified

REGULATIONS

STATE REGULATIONS:

The following components appear in one or more of the following state hazardous substances lists

<table>
<thead>
<tr>
<th>Component</th>
<th>CAS</th>
<th>CA</th>
<th>MA</th>
<th>MN</th>
<th>NJ</th>
<th>PA</th>
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<tr>
<td>Molybdenum</td>
<td>7439-98-7</td>
<td>No</td>
<td>No</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
<td>Yes</td>
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</table>

CALIFORNIA PROPOSITION 65: This product is not known to contain any components for which the State of California has found to cause cancer, birth defects or other reproductive harm.

CANADA

DOMESTIC SUBSTANCE LIST (INVENTORY): All components of this product are included in inventory, exempt, or notified

16. OTHER INFORMATION

APPROVED BY: EHS DEPT

PREPARED BY: E Bolton  Date Prepared: 4/2/2012

INFORMATION CONTACT: msds@lesker.com
MANUFACTURER DISCLAIMER:

Kurt J. Lesker Company ("KJLC") believes the information contained in this Material Safety Data Sheet is accurate as of the "Date of Last Revision" specified. The information relates only to typical properties of the product. Do not use the information for product performance or specification purposes. The information is for use by technically skilled persons at their own risk. KJLC MAKES NO EXPRESS OR IMPLIED WARRANTY OF ANY KIND, INCLUDING WITHOUT LIMITATION WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO THE PRODUCT OR THE INFORMATION. The information may not be valid for product use in combination with any other product or material or in any process. KJLC expressly disclaims any liability arising from any use of the product or any reliance on the information. Do not treat the information (a) as assurance that use of the product will not infringe patent or other rights or (b) as a license or grant of patent or other property rights. "KJLC" means KJLC and each of its subsidiaries.