MATERIAL SAFETY DATA SHEET
OSHA HAZARD COMMUNICATION RULE

DATE OF LAST REVISION: 04-29-96

### CHEMICAL IDENTITY

<table>
<thead>
<tr>
<th>LABEL IDENTITY</th>
<th>HAFNIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEMICAL NAME/SYNONYMS</td>
<td>CRYSTAL BAR HAFNIUM</td>
</tr>
<tr>
<td>FORMULA</td>
<td>Hf</td>
</tr>
<tr>
<td>CHEMICAL FAMILY</td>
<td>METAL</td>
</tr>
<tr>
<td>CAS REGISTRY NUMBER</td>
<td>7440-58-6 (Hf) 7440-67-7 (Zr)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HAZARDOUS INGREDIENTS</th>
<th>HAFNIUM, ZIRCONIUM</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hf %:</td>
<td>99.8</td>
</tr>
<tr>
<td>Zr %:</td>
<td>0.05</td>
</tr>
<tr>
<td>TLV:</td>
<td>0.5mg/m³</td>
</tr>
<tr>
<td>OSHA/PEL:</td>
<td>not established</td>
</tr>
</tbody>
</table>

### PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>COLOR, FORM AND ODOR</th>
<th>Gray-black, odorless</th>
</tr>
</thead>
<tbody>
<tr>
<td>BOILING POINT</td>
<td>4600°C</td>
</tr>
<tr>
<td>DENSITY (gm/cc)</td>
<td>NA</td>
</tr>
<tr>
<td>VAPOR PRESSURE @ 20°</td>
<td>0 @ 20°C</td>
</tr>
<tr>
<td>% VOLATILE BY VOLUME (%)</td>
<td>Non-volatile</td>
</tr>
<tr>
<td>REACTION WITH WATER</td>
<td>NA</td>
</tr>
<tr>
<td>EVAPORATION RATE (H₂O=1)</td>
<td>None</td>
</tr>
<tr>
<td>SOLUBILITY IN WATER</td>
<td>Insoluble</td>
</tr>
<tr>
<td>MELTING POINT</td>
<td>2227 + 20°C</td>
</tr>
</tbody>
</table>

### FIRE AND EXPLOSION HAZARD DATA

<table>
<thead>
<tr>
<th>FLASH POINT</th>
<th>ND</th>
</tr>
</thead>
<tbody>
<tr>
<td>AUTOIGNITION TEMPERATURE (°C)</td>
<td>NA</td>
</tr>
<tr>
<td>FLAMMABILITY</td>
<td>NA</td>
</tr>
<tr>
<td>EXTINGUISHING MEDIA</td>
<td>Use dry chemical, class D extinguisher</td>
</tr>
<tr>
<td>SPECIAL FIRE FIGHTING PROCEDURES</td>
<td>Wear NIOSH/MSHA approved self-contained breathing apparatus and full protective clothing</td>
</tr>
</tbody>
</table>

| UNUSUAL FIRE & EXPLOSION HAZARDS | DO NOT SPRAY WATER ON FIRES. Fine chips, turnings, sawdust or grinding dust produced may be flammable. |
HAFNIUM
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HEALTH HAZARD INFORMATION

TOXICITY DATA

No known toxicity

HMIS RATING:
HEALTH: 0   FLAMMABILITY: 0   REACTIVITY: 0   PERSONAL PROTECTION: ND

ROUTES OF ENTRY
INHALATION: ND
SKIN: ND
INGESTION: ND

MEDICAL CONDITIONS AGGRAVATED BY OVEREXPOSURE: NA

EFFECTS OF OVEREXPOSURE (acute and chronic):

INHALATION: none known
DERMAL/EYE CONTACT: none known
OTHER: no industrial disease has been evident with up to 20 years of exposure of Hafnium compounds

CARCINOGENICITY: NTP: no   IARC MONOGRAPHS: no   OSHA REGULATE: no

EMERGENCY FIRST AID PROCEDURES:

INGESTION: Administer water and induce vomiting, seek medical attention
INHALATION: Remove to fresh air, seek medical attention
SKIN CONTACT: Wash affected area with soap and water, seek medical attention
EYE CONTACT: Flush eyes for at least 15 minutes with lukewarm water, seek medical.

REACTIVITY DATA

STABILITY

Stable

CONDITIONS CONTRIBUTING TO UNSTABILITY

ND

INCOMPATIBILITY (MATERIALS TO AVOID)

Strong acids

HAZARDOUS DECOMPOSITION PRODUCTS

Does not decompose

HAZARDOUS POLYMERIZATION

Will Not Occur

CONDITIONS TO AVOID

Incompatible materials
HAFNIUM
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SAFE HANDLING AND USE

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED:
Wear full protective clothing, isolate area and ensure proper ventilation, vacuum spill and place in container for proper disposal.

WASTE DISPOSAL METHOD:
Consult federal, state and local regulations for proper disposal. Can be burned under controlled conditions

SPECIAL PROTECTIVE INFORMATION

RESPIRATORY PROTECTION
NIOSH approved respirator

LOCAL EXHAUST
NA

MECHANICAL (general)
NA

SPECIAL
NA

OTHER
NA

PROTECTIVE GLOVES
Recommended

EYE PROTECTION
Safety glasses with side shields

OTHER PROTECTIVE EQUIPMENT
Maintain sink, safety shower, and eyewash fountain in work area. Wear full protective clothing. DO NOT accumulate large quantities of fines or machining residue.

SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING/STORAGE:
Store in tightly closed containers in a cool, dry place. Wash hands and face thoroughly after handling and before eating.

TRANSPORTATION REQUIREMENTS
DOT CLASS: Non hazardous
UN NUMBER: ND
IMCO CLASS: ND
OTHER: 

PRECAUTIONARY LABELING
NONE

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NA= NOT APPLICABLE
ND= NO DATA FOUND