Section 1: PRODUCT AND COMPANY IDENTIFICATION

**Product identifier**
- **Product Name**: Hafnium Oxide
- **Product Code**: SAC005

**Other means of identification**
- **Synonyms**: Hafnium Oxide grades P, R, S and Spectro (Prod# 417, 404)

**Registration Number(s)**

**Recommended use of the chemical and restrictions on use**
- **Recommended Use**: Alloy product manufacture

**Uses advised against**

**Details of the supplier of the safety data sheet**
- **Manufacturer**: ATI, 1000 Six PPG Place, Pittsburgh, PA 15222 USA
- **Emergency telephone number**: Chemtrec +1 703-741-5970

Section 2: HAZARDS IDENTIFICATION

**Classification of the substance or mixture**
- Not a hazardous substance or mixture according to the Globally Harmonized System (GHS)

**Label elements**
- **Hazard statements**
- **Emergency Overview**
- **Appearance**: Powder
- **Physical state**: Solid
- **Odor**: Odorless

**Precautionary Statements - Prevention**
- 

**Precautionary Statements - Response**
- 

**Precautionary Statements - Storage**
- 

**Precautionary Statements - Disposal**
- 

**Other Information**
- Hazards not otherwise classified (HNOC)
  - Not applicable

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

**Synonyms**: Hafnium Oxide grades P, R, S and Spectro (Prod# 417, 404)

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Weight-%</th>
<th>ENCS</th>
<th>ISHL No.</th>
<th>CAS No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium Dioxide</td>
<td>96-100</td>
<td>X</td>
<td>-</td>
<td>12055-23-1</td>
</tr>
<tr>
<td>12055-23-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Section 4: FIRST AID MEASURES

Inhalation
If excessive amounts of smoke, fume, or particulate are inhaled during processing, remove to fresh air and consult a qualified health professional.

Skin Contact
None under normal use conditions.

Eye contact
In the case of particles coming in contact with eyes during processing, treat as with any foreign object.

Ingestion
IF SWALLOWED. Call a POISON CENTER or doctor/physician if you feel unwell.

Symptoms
None anticipated.

Inhalation
Product not classified.

Skin Contact
Product not classified.

Eye contact
Product not classified.

Ingestion
Product not classified.

Note to physicians
Treat symptomatically.

Section 5: FIRE FIGHTING MEASURES

Flammable properties
Non-combustible.

Explosive properties
Not applicable.

Suitable extinguishing media
Non-combustible.

Unsuitable extinguishing media
Non-combustible.

Specific hazards arising from the chemical
Non-combustible.

Hazardous combustion products
Not applicable.

Special protective equipment for fire-fighters
Firefighters should wear self-contained breathing apparatus and full firefighting turnout gear.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal precautions
Use personal protective equipment as required.
For emergency responders: Use personal protective equipment as required.

Environmental precautions: Collect spillage to prevent release to the environment.

Methods for containment: Prevent further leakage or spillage if safe to do so.

Methods for cleaning up: Sweep or shovel material into dry containers. Avoid creating uncontrolled dust.

Section 7: HANDLING AND STORAGE

Handling
Advice on safe handling: Handle in accordance with good industrial hygiene and safety practice.

Storage
Storage Conditions: Keep in properly labeled containers.

Incompatible materials: None known.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Japan</th>
<th>ISHL Working Environmental Evaluation Standards - Administrative Control Levels</th>
<th>ACGIH TLV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium Dioxide 12055-23-1</td>
<td>-</td>
<td>-</td>
<td>TWA: 0.5 mg/m³ Hf</td>
</tr>
<tr>
<td>Zirconium Dioxide 1314-23-4</td>
<td>-</td>
<td>-</td>
<td>STEL: 10 mg/m³ Zr TWA: 5 mg/m³ Zr</td>
</tr>
</tbody>
</table>

Engineering Controls: Avoid generation of uncontrolled particles.

Personal Protective Equipment

Respiratory protection: When particulates/fumes/gases are generated and if exposure limits are exceeded or irritation is experienced, proper approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

Eye/face protection: When airborne particles may be present, appropriate eye protection is recommended. For example, tight-fitting goggles, foam-lined safety glasses or other protective equipment that shield the eyes from particles.

Skin and body protection: Wear protective gloves.

General Hygiene Considerations: Handle in accordance with good industrial hygiene and safety practice.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks • Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Solid</td>
<td>Odorless</td>
</tr>
<tr>
<td>Appearance</td>
<td>Powder</td>
<td>Odor threshold</td>
</tr>
<tr>
<td>Color</td>
<td>white</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>2760 °C / 5000 °F</td>
<td></td>
</tr>
<tr>
<td>Boiling point / boiling range</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Flash point</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>-</td>
<td>Not flammable</td>
</tr>
<tr>
<td>Flammability Limit in Air</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Upper flammability limit:</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
**Section 10: STABILITY AND REACTIVITY**

**Reactivity**
Not applicable

**Stability**
Stable under normal conditions.

**Explosion data**
- Sensitivity to Mechanical Impact: None.
- Sensitivity to Static Discharge: None.

**Possibility of Hazardous Reactions**
None under normal processing

**Hazardous polymerization**
Hazardous polymerization does not occur

**Conditions to avoid**
Dust formation and dust accumulation

**Incompatible materials**
None known

**Hazardous Decomposition Products**
Not applicable

**Section 11: TOXICOLOGICAL INFORMATION**

**Information on likely routes of exposure**

**Product Information**

- **Inhalation**
  Product not classified.

- **Eye contact**
  Product not classified.

- **Skin Contact**
  Product not classified.

- **Ingestion**
  Product not classified.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium Dioxide</td>
<td>&gt;2000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
<tr>
<td>12055-23-1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium Dioxide</td>
<td>&gt;5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
<tr>
<td>1314-23-4</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Information on toxicological effects**
Symptoms

None known.

Acute toxicity

Numerical measures of toxicity - Product Information

Numerical measures of toxicity - Component Information

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Oral LD50</th>
<th>Dermal LD50</th>
<th>Inhalation LC50</th>
</tr>
</thead>
<tbody>
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<td>Hafnium Dioxide</td>
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</tr>
<tr>
<td>Zirconium Dioxide</td>
<td>&gt;5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
</tbody>
</table>

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Skin corrosion/irritation

Product not classified.

Serious eye damage/eye irritation

Product not classified.

Sensitization

Product not classified.

Germ cell mutagenicity

Product not classified.

Carcinogenicity

Product not classified.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Japan</th>
<th>IARC</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium Dioxide</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12055-23-1</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>Zirconium Dioxide</td>
<td></td>
<td>-</td>
</tr>
<tr>
<td>1314-23-4</td>
<td></td>
<td>-</td>
</tr>
</tbody>
</table>

Reproductive toxicity

Product not classified.

STOT - single exposure

Product not classified.

STOT - repeated exposure

Product not classified.

Target Organ Effects

.

Aspiration hazard

Product not classified.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity

This product as shipped is not classified for aquatic toxicity.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Algae/aquatic plants</th>
<th>Fish</th>
<th>Toxicity to microorganisms</th>
<th>Crustacea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium Dioxide</td>
<td>The 72 h EC50 of Hafnium dioxide in water to Pseudokirchneriella subcapitata was was greater than the solubility limit of 0.008 mg Hf/L</td>
<td>The 96 h LC50 of Hafnium dioxide in water to Danio rerio was greater than the solubility limit of 0.007 mg Hf/L</td>
<td>-</td>
<td>The 48 h EC50 of Hafnium dioxide to Daphnia magna was greater than the solubility limit of 0.007 mg Hf/L</td>
</tr>
</tbody>
</table>
Zirconium Dioxide | The 15 d NOEC of zirconium dichloride oxide to Chlorella vulgaris was greater than 200 mg/L | The 96 h LL50 of zirconium dioxide to Danio rerio was greater than 100 mg/L | - | The 48 h EC50 of zirconium dioxide to Daphnia magna was greater than 100 mg/L

Persistence and degradability
Bioaccumulation
Mobility

Other adverse effects

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>EU - Endocrine Disrupters Candidate List</th>
<th>EU - Endocrine Disruptors - Evaluated Substances</th>
<th>Endocrine disrupting potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium Dioxide</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Zirconium Dioxide</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Section 13: DISPOSAL CONSIDERATIONS

Waste from residues/unused products
Disposal should be in accordance with applicable regional, national and local laws and regulations.

Contaminated packaging
Disposal should be in accordance with applicable regional, national and local laws and regulations.

Section 14: TRANSPORT INFORMATION

IMDG
Not regulated

ICAO (air)
Not regulated

ADR
Not regulated

IATA
Japan
Not regulated

Section 15: REGULATORY INFORMATION

International Inventories

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>DSL/NDSL</td>
<td>Complies</td>
</tr>
<tr>
<td>EINECS/ELINCS</td>
<td>Complies</td>
</tr>
<tr>
<td>ENCS</td>
<td>Complies</td>
</tr>
<tr>
<td>IECSC</td>
<td>Complies</td>
</tr>
<tr>
<td>KECL</td>
<td>Complies</td>
</tr>
<tr>
<td>PICCS</td>
<td>Not Listed</td>
</tr>
<tr>
<td>AICS</td>
<td>Not Listed</td>
</tr>
</tbody>
</table>

Legend:
TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List
EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances
ENCS - Japan Existing and New Chemical Substances
IECSC - China Inventory of Existing Chemical Substances
KECL - Korean Existing and Evaluated Chemical Substances
PICCS - Philippines Inventory of Chemicals and Chemical Substances
AICS - Australian Inventory of Chemical Substances
### Industrial Safety and Health Law

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Class 2</th>
<th>Class 1</th>
<th>Poisonous and Deleterious Substances Control Law</th>
<th>Fire Service Law:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium Dioxide</td>
<td>Not applicable</td>
<td>-</td>
<td>Not applicable</td>
<td>-</td>
</tr>
<tr>
<td>12055-23-1</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Zirconium Dioxide</td>
<td>Not applicable</td>
<td>-</td>
<td>Not applicable</td>
<td>-</td>
</tr>
<tr>
<td>1314-23-4</td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Section 16: OTHER INFORMATION

**Prepared By**

**Issue Date** 28-May-2015

**Revision Date** 22-Jan-2018

**Revision Note** Updated Section(s): 2, 5, 8, 9, 10, 15.

**Key or legend to abbreviations and acronyms used in the safety data sheet**

*Note:
This SDS complies with the requirements of JIS Z 7250:2010 and JIS Z 7252:2009 (Japan)
The information provided in this safety data sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

**End of Safety Data Sheet**

**Additional information available** Safety data sheets and labels available at ATImetals.com