SAFETY DATA SHEET

Section 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

Product Code  SAC006
Product Name  Hafnium Sponge

UN/ID no  3089
Synonyms  Hafnium metal, porous (Product #402)

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

Recommended Use  Alloy product manufacture

Uses advised against

1.3. Details of the supplier of the safety data sheet

Manufacturer Address  ATI, 1000 Six PPG Place, Pittsburgh, PA 15222 USA

1.4. Emergency telephone number

Emergency Telephone  Chemtrec: +1-703-741-5970

Section 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

Regulation (EC) No 1272/2008

Flammable solids  Category 1

2.2. Label elements

Emergency Overview

Danger

Hazard statements  Flammable solids

Appearance  Sponge  Physical state  Solid  Odour  Odourless

Precautionary Statements - Prevention
Wear protective gloves/protective clothing/eye protection
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Ground/bond container and receiving equipment
If dust clouds can occur, use explosion-proof electrical/ventilating/lighting/equipment

Precautionary Statements - Response
In case of fire: Use salt (NaCl) or class D dry powder for extinction

2.3 Hazards not otherwise classified (HNOC)
Not applicable
Other Information

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Synonyms
Hafnium metal, porous (Product #402).

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>EC No</th>
<th>CAS No</th>
<th>Weight-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium</td>
<td>231-166-4</td>
<td>7440-58-6</td>
<td>97- &gt;99</td>
</tr>
<tr>
<td>Zirconium</td>
<td>231-176-9</td>
<td>7440-67-7</td>
<td>0-3</td>
</tr>
</tbody>
</table>

Section 4: FIRST AID MEASURES

4.1. Description of 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.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms
None anticipated.

4.3. Indication of any immediate medical attention and special treatment needed

Note to doctors
Treat symptomatically.

Section 5: FIRE FIGHTING MEASURES

5.1. Extinguishing media

Suitable extinguishing media
Smother with salt (NaCl) or class D dry powder fire extinguisher.

Unsuitable extinguishing media
Do not spray water on burning metal as an explosion may occur. This explosive characteristic is caused by the hydrogen and steam generated by the reaction of water with the burning material

5.2. Special hazards arising from the substance or mixture
Intense heat. Very fine, high surface area material resulting from grinding, buffing, polishing, or similar processes of this product may ignite spontaneously at room temperature WARNING: Fine particles resulting from grinding, buffing, polishing, or similar processes of this product may form combustible dust-air mixtures. Keep particles away from all ignition sources including heat, sparks, and flame. Prevent dust accumulations to minimise combustible dust hazard

Hazardous combustion products Not applicable.

5.3. Advice for firefighters

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

Section 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

Personal precautions
Use personal protective equipment as required.

For emergency responders
Use personal protective equipment as required. Follow Emergency Response Guidebook, Guide No. 170.

6.2. Environmental precautions

Collect spillage to prevent release to the environment.

6.3. Methods and material for containment and cleaning up

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.

6.4. Reference to other sections

See Section 12: ECOLOGICAL INFORMATION.

Section 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

Advice on safe handling
Very fine, high surface area material resulting from grinding, buffing, polishing, or similar processes of this product may ignite spontaneously at room temperature. WARNING: Fine particles resulting from grinding, buffing, polishing, or similar processes of this product may form combustible dust-air mixtures. Keep particles away from all ignition sources including heat, sparks, and flame. Prevent dust accumulations to minimise combustible dust hazard.

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

7.2. Conditions for safe storage, including any incompatibilities

Storage Conditions
Keep chips, turnings, dust, and other small particles away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity). For long-term storage, keep sealed in argon-filled steel drums. Keep tightly closed in a dry and cool place.

Incompatible materials
Dissolves in hydrofluoric acid. Ignites in the presence of fluorine. When heated above 200°C, reacts exothermically with the following. Chlorine, bromine, halocarbons, carbon tetrachloride, carbon tetrafluoride, and freon.

7.3. Specific end use(s)
Risk Management Methods (RMM)
The information required is contained in this Safety Data Sheet.

### Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

#### 8.1. Control parameters

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>European Union</th>
<th>United Kingdom</th>
<th>France</th>
<th>Spain</th>
<th>Germany</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium 7440-58-6</td>
<td>-</td>
<td>-</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>-</td>
</tr>
<tr>
<td>Zirconium 7440-67-7</td>
<td>TWA: 5 mg/m³</td>
<td>-</td>
<td>-</td>
<td>STEL: 10 mg/m³</td>
<td>TWA: 1 mg/m³ Ceiling / Peak: 1 mg/m³</td>
</tr>
<tr>
<td>Hafnium 7440-58-6</td>
<td>-</td>
<td>TWA: 0.5 mg/m³</td>
<td>-</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
</tr>
<tr>
<td>Zirconium 7440-67-7</td>
<td>STEL: 10 mg/m³</td>
<td>TWA: 5 mg/m³</td>
<td>-</td>
<td>TWA: 1 mg/m³</td>
<td>TWA: 5 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Italy</th>
<th>Portugal</th>
<th>Netherlands</th>
<th>Finland</th>
<th>Denmark</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium 7440-58-6</td>
<td>STEL 5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
</tr>
<tr>
<td>Zirconium 7440-67-7</td>
<td>TWA: 5 mg/m³</td>
<td>TWA: 5 mg/m³</td>
<td>STEL: 10 mg/m³</td>
<td>TWA: 5 mg/m³</td>
<td>STEL: 10 mg/m³</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Austria</th>
<th>Switzerland</th>
<th>Poland</th>
<th>Norway</th>
<th>Ireland</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium 7440-58-6</td>
<td>STEL 5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
</tr>
<tr>
<td>Zirconium 7440-67-7</td>
<td>TWA: 5 mg/m³</td>
<td>TWA: 5 mg/m³</td>
<td>STEL: 10 mg/m³</td>
<td>TWA: 5 mg/m³</td>
<td>STEL: 10 mg/m³</td>
</tr>
</tbody>
</table>

**Derived No Effect Level (DNEL)**

- Inhalation: 5 mg/m³

**Predicted No Effect Concentration (PNEC)**

No information available.

#### 8.2. Exposure controls

**Engineering Controls**

- Avoid generation of uncontrolled particles.

**Personal protective equipment**

**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 fire/flame resistant/retardant clothing. Cut-resistant gloves and/or protective clothing may be appropriate when sharp surfaces are present.

**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 contaminate concentrations. Respiratory protection must be provided in accordance with current local regulations.

**Environmental exposure controls**

- Section 6: ACCIDENTAL RELEASE MEASURES.

### Section 9: PHYSICAL AND CHEMICAL PROPERTIES

#### 9.1. Information on basic physical and chemical properties

<table>
<thead>
<tr>
<th>Property</th>
<th>Values</th>
<th>Remarks</th>
<th>Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Solid</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>Sponge</td>
<td>Odour</td>
<td>Odourless</td>
</tr>
<tr>
<td>Colour</td>
<td>grey Silver</td>
<td>Odour threshold</td>
<td>Not applicable</td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>2230 °C / 4040 °F</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boiling point / boiling range</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Flash point</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Evaporation rate</td>
<td>-</td>
<td></td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

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Flammability (solid, gas) - Flammable
Flammability Limit in Air
  Upper flammability limit: -
  Lower flammability limit: -
Vapour pressure - Not applicable
Vapour density - Not applicable
Specific Gravity 13.3
Water solubility Insoluble
Solubility(ies) Not applicable
Partition coefficient - Not applicable
Autoignition temperature - Not applicable
Decomposition temperature - Not applicable
Kinematic viscosity - Not applicable
Dynamic viscosity - Not applicable
Explosive properties Not applicable
Oxidising properties Not applicable

9.2. Other information
Softening point -
Molecular weight -
VOC Content (%) Not applicable
Density 130-170 lb/ft³
Bulk density -

Section 10: STABILITY AND REACTIVITY

10.1. Reactivity
Not applicable

10.2. Chemical stability
Stable under normal conditions.

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

10.3. Possibility of hazardous reactions
Hazardous polymerisation
Hazardous polymerisation does not occur.

Possibility of Hazardous Reactions
None under normal processing.

10.4. Conditions to avoid
Dust formation and dust accumulation.

10.5. Incompatible materials
Dissolves in hydrofluoric acid. Ignites in the presence of fluorine. When heated above 200°C, reacts exothermically with the following. Chlorine, bromine, halocarbons, carbon tetrachloride, carbon tetrafluoride, and freon.

10.6. Hazardous decomposition products
Not applicable.

Section 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects
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</td>
<td>&gt; 5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3mg/L</td>
</tr>
<tr>
<td>Zirconium</td>
<td>&gt; 5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
</tbody>
</table>

Information on toxicological effects

Symptoms: None known.

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.
Sensitisation: Product not classified.
Germ cell mutagenicity: Product not classified.
Carcinogenicity: Product not classified.
Reproductive toxicity: Product not classified.
STOT - single exposure: Product not classified.
STOT - repeated exposure: Product not classified.
Aspiration hazard: Product not classified.

Section 12: ECOLOGICAL INFORMATION

12.1. Toxicity
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 Micro-organisms</th>
<th>Crustacea</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium</td>
<td>The 72 h EC50 of hafnium to Pseudokirchneriella subcapitata was greater than 8 ug of Hf/L (100% saturated solution).</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>
<tr>
<td>Zirconium</td>
<td>The 14 d NOEC of zirconium dichloride oxide to Chlorella vulgaris was greater than 102.5 mg of Zr/L</td>
<td>The 96 h LL50 of zirconium to Danio rerio was greater than 74.03 mg/L.</td>
<td>-</td>
<td>The 48 h EC50 of zirconium dioxide to Daphnia magna was greater than 74.03 mg of Zr/L</td>
</tr>
</tbody>
</table>

12.2. Persistence and degradability

12.3. Bioaccumulative potential
12.4. Mobility in soil

12.5. Results of PBT and vPvB assessment

The PBT and vPvB criteria do not apply to inorganic substances.

12.6. Other adverse effects

Section 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

- **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**

<table>
<thead>
<tr>
<th>14.1 UN/ID no</th>
<th>3089</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.2 Proper shipping name</td>
<td>Metal powder, flammable, n.o.s. (Hafnium)</td>
</tr>
<tr>
<td>14.3 Hazard Class</td>
<td>4.1</td>
</tr>
<tr>
<td>14.4 Packing Group</td>
<td>II</td>
</tr>
<tr>
<td>14.5 Marine pollutant</td>
<td>Not applicable</td>
</tr>
<tr>
<td>14.6 Special Provisions</td>
<td>IB8, IP2, IP4, T3, TP33</td>
</tr>
<tr>
<td>14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>

**RID**

<table>
<thead>
<tr>
<th>14.1 UN/ID no</th>
<th>3089</th>
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<tbody>
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<td>14.3 Hazard Class</td>
<td>4.1</td>
</tr>
<tr>
<td>14.4 Packing Group</td>
<td>II</td>
</tr>
<tr>
<td>14.5 Environmental hazard</td>
<td>Not applicable</td>
</tr>
<tr>
<td>14.6 Special Provisions</td>
<td>IB8, IP2, IP4, T3, TP33</td>
</tr>
<tr>
<td>Note:</td>
<td>Follow Emergency Response Guidebook, Guide No. 170</td>
</tr>
</tbody>
</table>

**ADR**

<table>
<thead>
<tr>
<th>14.1 UN/ID no</th>
<th>3089</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.2 Proper shipping name</td>
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</tr>
<tr>
<td>14.3 Hazard Class</td>
<td>4.1</td>
</tr>
<tr>
<td>14.4 Packing Group</td>
<td>II</td>
</tr>
<tr>
<td>14.5 Environmental hazard</td>
<td>Not applicable</td>
</tr>
<tr>
<td>14.6 Special Provisions</td>
<td>IB8, IP2, IP4, T3, TP33</td>
</tr>
<tr>
<td>Note:</td>
<td>Follow Emergency Response Guidebook, Guide No. 170</td>
</tr>
</tbody>
</table>

**ICAO (air)**

<table>
<thead>
<tr>
<th>14.1 UN/ID no</th>
<th>3089</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.2 Proper shipping name</td>
<td>Metal powder, flammable, n.o.s. (Hafnium)</td>
</tr>
<tr>
<td>14.3 Hazard Class</td>
<td>4.1</td>
</tr>
<tr>
<td>14.4 Packing Group</td>
<td>II</td>
</tr>
<tr>
<td>14.5 Environmental hazard</td>
<td>Not applicable</td>
</tr>
<tr>
<td>14.6 Special Provisions</td>
<td>IB8, IP2, IP4, T3, TP33</td>
</tr>
</tbody>
</table>

**IATA**

| 14.1 UN/ID no   | 3089              |
14.2 Proper shipping name  Metal powder, flammable, n.o.s. (Hafnium)
14.3 Hazard Class  4.1
14.4 Packing Group  II
14.5 Environmental hazard  Not applicable
14.6 Special Provisions  IB8, IP2, IP4, T3, TP33  170

Section 15: REGULATORY INFORMATION

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

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>French RG number</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hafnium</td>
<td>7440-58-6</td>
<td>-</td>
</tr>
<tr>
<td>Zirconium</td>
<td>7440-67-7</td>
<td>-</td>
</tr>
</tbody>
</table>

European Union

Take note of Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

Authorisations and/or restrictions on use:
This product does not contain substances subject to authorisation (Regulation (EC) No. 1907/2006 (REACH), Annex XIV). This product does not contain substances subject to restriction (Regulation (EC) No. 1907/2006 (REACH), Annex XVII).

International Inventories

- DSL/NDSL  Complies
- EINECS/ELINCS  Complies
- ENCS  Complies
- IECSC  Complies
- KECL  Complies
- PICCS  Complies
- AICS  Does not comply

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

15.2. Chemical safety assessment

No chemical safety assessment has been performed for this product.

Section 16: OTHER INFORMATION

Issue Date  28-May-2015
Revision Date  21-Nov-2016
Revision Note  Updated Section(s): 2, 6, 14.

This material safety data sheet complies with the requirements of Regulation (EC) No. 1907/2006
Note:
The information provided in this Material 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.

Additional information available from:

Safety data sheets and labels available at ATImetals.com

End of Safety Data Sheet