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

1.1. Product identifier

Product Code  SAC045

Product Name  Hafnium-Nickel Alloys

Synonyms  Applies to all massive Hafnium-Nickel Alloys

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

<table>
<thead>
<tr>
<th>Classification</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin sensitisation</td>
<td>Category 1</td>
</tr>
<tr>
<td>Carcinogenicity</td>
<td>Category 2</td>
</tr>
<tr>
<td>Specific target organ toxicity (repeated exposure)</td>
<td>Category 1</td>
</tr>
</tbody>
</table>

2.2. Label elements

Danger

Hazard statements

May cause an allergic skin reaction
Suspected of causing cancer
Causes damage to the respiratory tract through prolonged or repeated exposure if inhaled

![Danger symbol]

Appearance  Various massive product forms

Physical state  Solid

Odour  Odourless
Precautionary Statements - Prevention
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wear protective gloves

Precautionary Statements - Response
If skin irritation or rash occurs: Get medical advice/attention

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

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

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances
Synonyms
Applies to all massive Hafnium-Nickel Alloys.

<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>80-99</td>
</tr>
<tr>
<td>Nickel</td>
<td>231-111-4</td>
<td>7440-02-0</td>
<td>1-20</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
In the case of skin irritation or allergic reactions see a doctor. Wash off immediately with soap and plenty of water.

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

Ingestion
Not an expected route of exposure.

4.2. Most important symptoms and effects, both acute and delayed
Symptoms
May cause allergic skin reaction.

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
Product not flammable in the form as distributed, flammable as finely divided particles or pieces resulting from processing of this product.
Small Fire Smother with salt (NaCl) or class D dry powder fire extinguisher.

Large Fire Isolate fire and allow to burn out.

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.

5.3. Advice for firefighters
Wear self-contained breathing apparatus and protective suit. Use personal protective equipment as required.

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.

6.2. Environmental precautions
Not applicable to massive product.

6.3. Methods and material for containment and cleaning up

Methods for containment Not applicable to massive product.

Methods for cleaning up Not applicable to massive product.

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).
Incompatible materials
Dissolves in hydrofluoric acid,

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</td>
<td></td>
<td></td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
<td>-</td>
</tr>
<tr>
<td>7440-58-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td></td>
<td>STEL: 1.5 mg/m³</td>
<td>TWA: 1 mg/m³</td>
<td>TWA: 1 mg/m³</td>
<td>Skin</td>
</tr>
<tr>
<td>7440-02-0</td>
<td></td>
<td>TWA: 0.5 mg/m³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Italy</td>
<td>Portugal</td>
<td>Netherlands</td>
<td>Finland</td>
<td>Denmark</td>
</tr>
<tr>
<td>Hafnium</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>7440-58-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td></td>
<td>TWA: 1.5 mg/m³</td>
<td>-</td>
<td>TWA: 1 mg/m³</td>
<td>TWA: 0.05 mg/m³</td>
</tr>
<tr>
<td>7440-02-0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Austria</td>
<td>Switzerland</td>
<td>Poland</td>
<td>Norway</td>
<td>Ireland</td>
</tr>
<tr>
<td>Hafnium</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>7440-58-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td></td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 0.25 mg/m³</td>
<td>TWA: 0.05 mg/m³</td>
<td>TWA: 0.5 mg/m³</td>
</tr>
<tr>
<td>7440-02-0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Derived No Effect Level (DNEL) No DNELs are available for this product as a whole
Predicted No Effect Concentration (PNEC) No PNECs are available for this product as a whole.

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 • Method</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical state</td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td>Appearance</td>
<td>Various massive product forms</td>
<td></td>
</tr>
<tr>
<td>Colour</td>
<td>metallic, grey or Silver</td>
<td>Odourless</td>
</tr>
<tr>
<td>Odour threshold</td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>1200-1500 °C / 2200-2700 °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></td>
</tr>
</tbody>
</table>
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,

10.6. Hazardous decomposition products

Not applicable.

Section 11: TOXICOLOGICAL INFORMATION

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

9.2. Other information

Softening point  -
Molecular weight  -
VOC Content (%)  Not applicable
Density  -
Bulk density  0.441 lb/in3

Section 10: STABILITY AND REACTIVITY

10.1. Reactivity

Not applicable

10.2. Chemical stability

Stable under normal conditions.

Section 11: TOXICOLOGICAL INFORMATION

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

9.2. Other information

Softening point  -
Molecular weight  -
VOC Content (%)  Not applicable
Density  -
Bulk density  0.441 lb/in3

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,

10.6. Hazardous decomposition products

Not applicable.
11.1. Information on toxicological effects

### Product Information

- **Inhalation**: Not an expected route of exposure for product in massive form.
- **Eye contact**: Not an expected route of exposure for product in massive form.
- **Skin Contact**: May cause sensitisation by skin contact.
- **Ingestion**: Not an expected route of exposure for product in massive form.

<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; 4.3 mg/L</td>
</tr>
<tr>
<td>Nickel</td>
<td>&gt; 9000 mg/kg bw</td>
<td>-</td>
<td>&gt; 10.2 mg/L</td>
</tr>
</tbody>
</table>

### Information on toxicological effects

#### Symptoms

May cause sensitisation by skin contact.

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

- **Acute toxicity**: Product not classified.
- **Skin corrosion/irritation**: Product not classified.
- **Serious eye damage/eye irritation**: Product not classified.
- **Sensitisation**: May cause sensitisation by skin contact.
- **Germ cell mutagenicity**: Product not classified.
- **Carcinogenicity**: May cause cancer by inhalation.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH</th>
<th>IARC</th>
<th>NTP</th>
<th>OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel 7440-02-0</td>
<td></td>
<td>Group 1</td>
<td>Known</td>
<td>X</td>
</tr>
</tbody>
</table>

- **Reproductive toxicity**: Product not classified.
- **STOT - single exposure**: Product not classified.
- **STOT - repeated exposure**: Causes disorder and damage to the Respiratory System.
- **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>Nickel</td>
<td>NOEC/EC10 values range from 12.3 µg/l for Scenedesmus accumulatus to 425 µg/l for Pseudokirchneriella subcapitata.</td>
<td>The 96h LC50s values range from 0.4 mg Ni/L for Pimephales promelas to 320 mg Ni/L for Brachydanio rerio.</td>
<td>The 30 min EC50 of nickel for activated sludge was 33 mg Ni/L.</td>
<td>The 48h LC50s values range from 0.013 mg Ni/L for Ceriodaphnia dubia to 4970 mg Ni/L for Daphnia magna.</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

None anticipated.

---

Section 14: TRANSPORT INFORMATION

IMDG

14.1 UN/ID no
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard Class
Not regulated

14.4 Packing Group
Not regulated

14.5 Marine pollutant
Not applicable

14.6 Special Provisions
None

14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code
Not applicable

RID

14.1 UN/ID no
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard Class
Not regulated

14.4 Packing Group
Not regulated

14.5 Environmental hazard
Not applicable

14.6 Special Provisions
None

ADR

14.1 UN/ID no
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard Class
Not regulated

14.4 Packing Group
Not regulated

14.5 Environmental hazard
Not applicable

14.6 Special Provisions
None

ICAO (air)

14.1 UN/ID no
Not regulated

14.2 Proper shipping name
Not regulated

14.3 Hazard Class
Not regulated

14.4 Packing Group
Not applicable
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>-</td>
<td>-</td>
</tr>
<tr>
<td>7440-58-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>RG 37ter</td>
<td>-</td>
</tr>
<tr>
<td>7440-02-0</td>
<td></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

- **TSCA**: Complies
- **DSL/NDSL**: Complies
- **EINECS/ELINCS**: Complies
- **ENCS**: Complies
- **IECSC**: Complies
- **KECL**: Complies
- **PICCS**: Complies
- **AICS**: Not Listed

**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**
08-Mar-2017

**Revision Date**
08-Mar-2017
Revision Note

Updated Section(s): 15.

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.

End of Safety Data Sheet

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