1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier
Product Name
Zirconium and Zirconium Alloys: Powder, Fines, and Dust

Other means of identification
Product Code
SAC009
UN/ID No.
UN3089
Synonyms
Includes all dry powder, fines, and dust products of zirconium and zirconium alloys (Product #303)

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 Address
ATI, 1000 Six PPG Place, Pittsburgh, PA 15222 USA
Emergency telephone number
Chemtrec: 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable solids
Category 1

Label elements

Emergency Overview

Danger

Hazard statements
Flammable solids

Appearance
Powder

Physical state
Solid

Odor
Odorless

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

Hazards not otherwise classified (HNOC)
Not applicable

Other Information
When product is subjected to welding, burning, melting, sawing, brazing, grinding, buffing, polishing, or other similar heat-generating processes, the following potentially hazardous airborne particles and/or fumes may be generated: Hexavalent Chromium (Chromium VI) may cause lung, nasal, and/or sinus cancer. Soluble molybdenum compounds such as molybdenum trioxide may cause lung irritation.

### 3. COMPOSITION/INFORMATION ON INGREDIENTS

#### Synonyms
Includes all dry powder, fines, and dust products of zirconium and zirconium alloys (Product #303).

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Weight-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium</td>
<td>7440-67-7</td>
<td>90- &gt;99</td>
</tr>
<tr>
<td>Hafnium</td>
<td>7440-58-6</td>
<td>0-10</td>
</tr>
<tr>
<td>Niobium (Columbium)</td>
<td>7440-03-1</td>
<td>0-4</td>
</tr>
<tr>
<td>Tin</td>
<td>7440-31-5</td>
<td>0-3</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>7439-98-7</td>
<td>0-2</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>0-1</td>
</tr>
<tr>
<td>Iron</td>
<td>7439-89-6</td>
<td>0-1</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>0-0.1</td>
</tr>
</tbody>
</table>

### 4. FIRST AID MEASURES

**First aid measures**

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

**Skin Contact**
In the case of skin irritation or allergic reactions see a physician. Wash off immediately with soap and plenty of water.

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

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

**Most important symptoms and effects, both acute and delayed**

**Symptoms**
May cause allergic skin reaction.

**Indication of any immediate medical attention and special treatment needed**

**Note to physicians**
Treat symptomatically.

### 5. FIRE-FIGHTING MEASURES

**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...
Specific hazards arising from the chemical
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 minimize combustible dust hazard.

Hazardous combustion products
Hexavalent Chromium (Chromium VI) may cause lung, nasal, and/or sinus cancer. Soluble molybdenum compounds such as molybdenum trioxide may cause lung irritation.

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

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

6. ACCIDENTAL RELEASE MEASURES

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.

Environmental precautions

Environmental precautions
Collect spillage to prevent release to the environment.

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.

7. HANDLING AND STORAGE

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 minimize combustible dust hazard.

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.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters
SAC009 Zirconium and Zirconium Alloys: Powder, Fines, and Dust

Revision Date 26-Nov-2016

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium</td>
<td>7440-67-7</td>
<td>STEL: 10 mg/m³ STEL: 10 mg/m³ Zr</td>
<td>TWA: 5 mg/m³ Zr</td>
</tr>
<tr>
<td></td>
<td></td>
<td>TWA: 5 mg/m³ TWA: 5 mg/m³ Zr</td>
<td>(vacated) STEL: 10 mg/m³ (vacated) STEL: 10 mg/m³ Zr</td>
</tr>
<tr>
<td>Hafnium</td>
<td>7440-58-6</td>
<td>TWA: 0.5 mg/m³ TWA: 0.5 mg/m³ Hf</td>
<td>TWA: 0.5 mg/m³</td>
</tr>
<tr>
<td>Niobium (Columbium)</td>
<td>7440-03-1</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tin</td>
<td>7440-31-5</td>
<td>TWA: 2 mg/m³ TWA: 2 mg/m³ Sn except</td>
<td>TWA: 2 mg/m³ Sn except oxides</td>
</tr>
<tr>
<td>Molybdenum</td>
<td>7439-98-7</td>
<td>TWA: 10 mg/m³ inhalable fraction</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>7439-89-6</td>
<td>TWA: 3 mg/m³ respirable fraction</td>
<td>-</td>
</tr>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>TWA: 0.5 mg/m³</td>
<td>TWA: 1 mg/m³</td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>TWA: 1.5 mg/m³ inhalable fraction</td>
<td>TWA: 1 mg/m³</td>
</tr>
</tbody>
</table>

**Appropriate engineering controls**

Engineering Controls Avoid generation of uncontrolled particles.

Individual protection measures, such as 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**

Fire/flame resistant/retardant clothing may be appropriate during hot work with the product.

**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.

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

# 9. PHYSICAL AND CHEMICAL PROPERTIES

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>Powder</td>
<td>Odor</td>
</tr>
<tr>
<td>Color</td>
<td>metallic; gray or silver</td>
<td>Odorless</td>
</tr>
<tr>
<td>Property</td>
<td>Values</td>
<td>Remarks • Method</td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>1830-1870 °C / 3330-3400 °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>
<tr>
<td>Evaporation rate</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>-</td>
<td>Flammable</td>
</tr>
<tr>
<td>Flammability Limit in Air</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Upper flammability limit:</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Lower flammability limit:</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Vapor pressure</td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Vapor density</td>
<td>6.49-6.64</td>
<td>Not applicable</td>
</tr>
<tr>
<td>Specific Gravity</td>
<td>Insoluble</td>
<td></td>
</tr>
<tr>
<td>Water solubility</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Solubility in other solvents</td>
<td>-</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
Partition coefficient  -  Not applicable
Autoignition temperature  -  Not applicable
Decomposition temperature  -  Not applicable
Kinematic viscosity  -  Not applicable
Dynamic viscosity  -  Not applicable
Explosive properties  Not applicable
Oxidizing properties  Not applicable

Other Information

Softening point  -
Molecular weight  -
VOC Content (%)  Not applicable
Density  110-190 lb/ft3
Bulk density  -

10. STABILITY AND REACTIVITY

Reactivity
Not applicable

Chemical stability
Stable under normal conditions.

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
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.

Hazardous Decomposition Products
When product is subjected to welding, burning, melting, sawing, brazing, grinding, buffing, polishing, or other similar heat-generating processes, the following potentially hazardous airborne particles and/or fumes may be generated: Hexavalent Chromium (Chromium VI) may cause lung, nasal, and/or sinus cancer, Soluble molybdenum compounds such as molybdenum trioxide may cause lung irritation.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Inhalation  Product not classified.
Eye contact  Product not classified.
Skin Contact  May cause sensitization by skin contact.
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>Zirconium</td>
<td>&gt; 5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
<tr>
<td>7440-67-7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hafnium</td>
<td>&gt; 5000 mg/kg bw</td>
<td>-</td>
<td>&gt;4.3 mg/L</td>
</tr>
<tr>
<td>7440-58-6</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
SAC009 Zirconium and Zirconium Alloys: Powder, Fines, and Dust

Revision Date 26-Nov-2016

Niobium (Columbium) 7440-03-1
> 10,000 mg/kg bw > 2000 mg/kg bw -

Tin 7440-31-5
> 2000 mg/kg bw > 2000 mg/kg bw > 4.75 mg/L

Molybdenum 7439-98-7
> 2000 mg/kg bw > 2000 mg/kg bw > 5.10 mg/L

Iron 7439-89-6
98,600 mg/kg bw - > 0.25 mg/L

Chromium 7440-47-3
> 3400 mg/kg bw - > 5.41 mg/L

Nickel 7440-02-0
> 9000 mg/kg bw - > 10.2 mg/L

Information on toxicological effects

Symptoms
May cause sensitization 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.

Sensitization
May cause sensitization by skin contact.

Germ cell mutagenicity
Product not classified.

Carcinogenicity
Product not classified.

Chemical Name ACGIH IARC NTP OSHA
Chromium 7440-47-3 Group 3 - -
Nickel 7440-02-0 Group 1 Known X

Reproductive toxicity
Product not classified.

STOT - single exposure
Product not classified.

STOT - repeated exposure
Product not classified.

Aspiration hazard
Product not classified.

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>Zirconium 7440-67-7</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>
<tr>
<td>Hafnium 7440-58-6</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>Niobium (Columbium) 7440-03-1</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Tin 7440-31-5</td>
<td>The 72 h EC50 of tin chloride pentahydrate to Pseudokirchneriella subcapitata was 9,846 ug of Sn/L</td>
<td>The 7 d LOEC of tin chloride pentahydrate to Pimephales promelas was 827.9 ug of Sn/L</td>
<td>-</td>
<td>The 7 d LC50 of tin chloride pentahydrate to Ceriodaphnia dubia was greater than 3,200 ug of Sn/L.</td>
</tr>
<tr>
<td>Molybdenum 7439-98-7</td>
<td>The 72 h EC50 of sodium molybdate dihydrate to</td>
<td>The 96 h LC50 of sodium molybdate dihydrate to</td>
<td>The 3 h EC50 of molybdenum trioxide to</td>
<td>The 48 h LC50 of sodium molybdate dihydrate to</td>
</tr>
</tbody>
</table>
Pseudokirchneriella subcapitata was 362.9 mg of Mo/L.  
Pimephales promelas was 644.2 mg/L.  
activated sludge was 820 mg/L.  
Ceriodaphnia dubia was 1,015 mg/L.  

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>RCRA - D Series Wastes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>5.0 mg/L regulatory level</td>
</tr>
<tr>
<td>7440-47-3</td>
<td></td>
</tr>
</tbody>
</table>

13. DISPOSAL CONSIDERATIONS

Waste treatment methods
Disposal of wastes
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.

14. TRANSPORT INFORMATION

DOT
Regulated

UN/ID No.
UN3089

Proper shipping name
Metal powder, flammable, n.o.s. (Zirconium)

Hazard Class
4.1

Packing Group
II

Special Provisions
IB8, IP2, IP4, T3, TP33

Emergency Response Guide Number
170

15. REGULATORY INFORMATION

International Inventories
TSCA
Complies

DSL/NDSL
Complies
Chemical Name | CAS No. | Weight-% | SARA 313 - Threshold Values %
--- | --- | --- | ---
Chromium - 7440-47-3 | 7440-47-3 | 0-1 | 1.0
Nickel - 7440-02-0 | 7440-02-0 | 0-0.1 | 0.1

**SARA 311/312 Hazard Categories**

- Acute health hazard: No
- Chronic Health Hazard: No
- Fire hazard: Yes
- Sudden release of pressure hazard: No
- Reactive Hazard: No

**CWA (Clean Water Act)**

This product contains the following substances which are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CWA - Reportable Quantities</th>
<th>CWA - Toxic Pollutants</th>
<th>CWA - Priority Pollutants</th>
<th>CWA - Hazardous Substances</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>7440-47-3</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

**CERCLA**

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>Hazardous Substances RQs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td>5000 lb</td>
</tr>
<tr>
<td>Nickel</td>
<td>100 lb</td>
</tr>
</tbody>
</table>

**US State Regulations**

**California Proposition 65**

This product contains the following Proposition 65 chemicals

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>California Proposition 65</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel - 7440-02-0</td>
<td>Carcinogen</td>
</tr>
</tbody>
</table>
U.S. State Right-to-Know Regulations

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>New Jersey</th>
<th>Massachusetts</th>
<th>Pennsylvania</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zirconium 7440-67-7</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Hafnium 7440-58-6</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Tin 7440-31-5</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Molybdenum 7439-98-7</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Chromium 7440-47-3</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>Nickel 7440-02-0</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
</tbody>
</table>

U.S. EPA Label Information
EPA Pesticide Registration Number Not applicable

16. OTHER INFORMATION

<table>
<thead>
<tr>
<th>NFPA</th>
<th>Health hazards</th>
<th>Flammability</th>
<th>Instability</th>
<th>Physical and Chemical Properties</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>-</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HMIS</th>
<th>Health hazards</th>
<th>Flammability</th>
<th>Physical hazards</th>
<th>Personal protection</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1*</td>
<td>2</td>
<td>0</td>
<td>X</td>
</tr>
</tbody>
</table>

Chronic Hazard Star Legend
* = Chronic Health Hazard

Issue Date 28-May-2015
Revision Date 26-Nov-2016
Revision Note Updated Section(s): 2, 6, 7, 14

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