



# SAFETY DATA SHEET

Issue Date 28-May-2015

Revision Date 16-Sep-2016

Version 4

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

**Product identifier**

**Product Name** Zirconium and Zirconium Alloys

**Other means of identification**

**Product Code**

SAC001

**Synonyms**

Zirconium and Zirconium Alloys: Includes the following non-powder products: Zirconium foil, Zircaloy-2, Zircaloy-4, Zr-2.5Nb, ZrNb705, Zircadyne 702, Zircadyne 704, Zircadyne 706, ASTM Grades B350-R60802, B350-B60804, B350-B60901, B352-R60812, B352-R60814, B493-R60704, B493-R60705, B493-R60706 (Product #334)

**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**

**Emergency Telephone** Chemtrec: 1-800-424-9300

## 2. HAZARDS IDENTIFICATION

**Classification**

This chemical is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

**Label elements**

**Emergency Overview**

<b>Appearance</b> Various massive product forms	<b>Physical state</b> Solid	<b>Odor</b> Odorless
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**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**

Zirconium and Zirconium Alloys: Includes the following non-powder products: Zirconium foil,

Zircaloy-2, Zircaloy-4, Zr-2.5Nb, ZrNb705, Zircadyne 702, Zircadyne 704, Zircadyne 706, ASTM Grades B350-R60802, B350-B60804, B350-B60901, B352-R60812, B352-R60814, B493-R60704, B493-R60705, B493-R60706, (Product #334).

Chemical Name	CAS No.	Weight-%
Zirconium	7440-67-7	90-98.5
Hafnium	7440-58-6	0.005-10
Niobium (Columbium)	7440-03-1	0-4
Tin	7440-31-5	0-3
Molybdenum	7439-98-7	0-2
Chromium	7440-47-3	0-1
Iron	7439-89-6	0.1-1
Nickel	7440-02-0	0-0.1

#### 4. FIRST AID MEASURES

##### First aid measures

<b>Eye contact</b>	In the case of particles coming in contact with eyes during processing, treat as with any foreign object.
<b>Skin Contact</b>	In the case of skin irritation or allergic reactions see a physician.
<b>Inhalation</b>	If excessive amounts of smoke, fume, or particulate are inhaled during processing, remove to fresh air and consult a qualified health professional.
<b>Ingestion</b>	Not an expected route of exposure.
<b><u>Most important symptoms and effects, both acute and delayed</u></b>	
<b>Symptoms</b>	May cause allergic skin reaction.
<b><u>Indication of any immediate medical attention and special treatment needed</u></b>	
<b>Note to physicians</b>	Treat symptomatically.

#### 5. FIRE-FIGHTING MEASURES

##### Suitable extinguishing media

Not flammable in the form of this product as distributed, flammable as finely divided particles or pieces resulting from processing of this product. 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.

##### 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. Zirconium foil may ignite if exposed to temperatures between 350-450°C, depending on foil thickness and rate of heating.

**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.

### Environmental precautions

**Environmental precautions** Not applicable to massive product.

### 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.

## 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. Zirconium foil may ignite if exposed to temperatures between 350-450°C, depending on foil thickness and rate of heating.

### 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, 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

#### Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL
Zirconium 7440-67-7	STEL: 10 mg/m <sup>3</sup> STEL: 10 mg/m <sup>3</sup> Zr TWA: 5 mg/m <sup>3</sup> TWA: 5 mg/m <sup>3</sup> Zr	TWA: 5 mg/m <sup>3</sup> Zr (vacated) STEL: 10 mg/m <sup>3</sup> (vacated) STEL: 10 mg/m <sup>3</sup> Zr
Hafnium 7440-58-6	TWA: 0.5 mg/m <sup>3</sup> TWA: 0.5 mg/m <sup>3</sup> Hf	TWA: 0.5 mg/m <sup>3</sup>
Niobium (Columbium) 7440-03-1	-	-
Tin 7440-31-5	TWA: 2 mg/m <sup>3</sup> TWA: 2 mg/m <sup>3</sup> Sn except Tin hydride	TWA: 2 mg/m <sup>3</sup> Sn except oxides
Molybdenum 7439-98-7	TWA: 10 mg/m <sup>3</sup> inhalable fraction TWA: 3 mg/m <sup>3</sup> respirable fraction	-
Iron 7439-89-6	-	-
Chromium	TWA: 0.5 mg/m <sup>3</sup>	TWA: 1 mg/m <sup>3</sup>

7440-47-3		
Nickel 7440-02-0	TWA: 1.5 mg/m <sup>3</sup> inhalable fraction	TWA: 1 mg/m <sup>3</sup>

**Appropriate engineering controls**

**Engineering Controls** Avoid generation of uncontrolled particles.

**Individual protection measures, such as personal protective equipment**

<b>Eye/face protection</b>	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.
<b>Skin and body protection</b>	Fire/flame resistant/retardant clothing may be appropriate during hot work with the product. Cut-resistant gloves and/or protective clothing may be appropriate when sharp surfaces are present.
<b>Respiratory protection</b>	When particulates 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**

<b>Physical state</b>	Solid	<b>Odor</b>	Odorless
<b>Appearance</b>	Various massive product forms	<b>Odor threshold</b>	Not applicable
<b>Color</b>	metallic, gray, silver		
<b>Property</b>	<b>Values</b>	<b>Remarks • Method</b>	
<b>pH</b>	-		
<b>Melting point/freezing point</b>	1850 °C / 3362 °F		
<b>Boiling point / boiling range</b>	-		
<b>Flash point</b>	-		
<b>Evaporation rate</b>	-	Not applicable	
<b>Flammability (solid, gas)</b>	350-450 °C (Zr foil only)	Not flammable in the form of this product as distributed, flammable as finely divided particles or pieces resulting from processing of this product. Foil products may ignite between 350-450°C, depending on foil thickness and rate of heating.	
<b>Flammability Limit in Air</b>			
<b>Upper flammability limit:</b>	-		
<b>Lower flammability limit:</b>	-		
<b>Vapor pressure</b>	-	Not applicable	
<b>Vapor density</b>	-	Not applicable	
<b>Specific Gravity</b>	6.49		
<b>Water solubility</b>	Insoluble		
<b>Solubility in other solvents</b>	-	Not applicable	
<b>Partition coefficient</b>	-	Not applicable	
<b>Autoignition temperature</b>	-	Not applicable	
<b>Decomposition temperature</b>	-	Not applicable	
<b>Kinematic viscosity</b>	-	Not applicable	
<b>Dynamic viscosity</b>	-	Not applicable	
<b>Explosive properties</b>	Not applicable		
<b>Oxidizing properties</b>	Not applicable		

**Other Information**

**Softening point** -

<b>Molecular weight</b>	-
<b>VOC Content (%)</b>	Not applicable
<b>Density</b>	-
<b>Bulk density</b>	-

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

## 11. TOXICOLOGICAL INFORMATION

### Information on likely routes of exposure

#### Product Information

<b>Inhalation</b>	Not an expected route of exposure for product in massive form.
<b>Eye contact</b>	Not an expected route of exposure for product in massive form.
<b>Skin Contact</b>	May cause sensitization by skin contact.
<b>Ingestion</b>	Not an expected route of exposure for product in massive form.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Zirconium 7440-67-7	5000 mg/kg bw	-	>4.3 mg/L
Hafnium 7440-58-6	> 5000 mg/kg bw	-	>4.3mg/L
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 Group 2B	Known Reasonably Anticipated	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.

Chemical Name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Zirconium 7440-67-7	The 14 d NOEC of zirconium dichloride oxide to <i>Chlorella vulgaris</i> was greater than 102.5 mg of Zr/L.	The 96 h LL50 of zirconium to <i>Danio rerio</i> was greater than 74.03 mg/L.	-	The 48 h EC50 of zirconium dioxide to <i>Daphnia magna</i> was greater than 74.03 mg of Zr/L.
Hafnium 7440-58-6	The 72 h EC50 of hafnium to <i>Pseudokirchneriella subcapitata</i> was greater than 8 ug of Hf/L (100% saturated solution).	The 96 h LC50 of Hafnium dioxide in water to <i>Danio rerio</i> was greater than the solubility limit of 0.007 mg Hf/L.	-	The 48 h EC50 of Hafnium dioxide to <i>Daphnia magna</i> was greater than the solubility limit of 0.007 mg Hf/L.
Niobium (Columbium) 7440-03-1	-	-	-	-
Tin 7440-31-5	The 72 h EC50 of tin chloride pentahydrate to <i>Pseudokirchnerella subcapitata</i> was 9,846 ug of Sn/L.	The 7 d LOEC of tin chloride pentahydrate to <i>Pimephales promelas</i> was 827.9 ug of Sn/L.	-	The 7 d LC50 of tin chloride pentahydrate to <i>Ceriodaphnia dubia</i> was greater than 3,200 ug of Sn/L.
Molybdenum 7439-98-7	The 72 h EC50 of sodium molybdate dihydrate to <i>Pseudokirchneriella subcapitata</i> was 362.9 mg of Mo/L.	The 96 h LC50 of sodium molybdate dihydrate to <i>Pimephales promelas</i> was 644.2 mg/L.	The 3 h EC50 of molybdenum trioxide for activated sludge was 820 mg/L.	The 48 h LC50 of sodium molybdate dihydrate to <i>Ceriodaphnia dubia</i> was 1,015 mg/L. The 48 h LC50 of sodium molybdate dihydrate to <i>Daphnia magna</i> was greater than 1,727.8 mg/L.
Iron 7439-89-6	-	The 96 h LC50 of 50% iron oxide black in water to <i>Danio rerio</i> was greater than 10,000 mg/L.	The 3 h EC50 of iron oxide for activated sludge was greater than 10,000 mg/L.	The 48 h EC50 of iron oxide to <i>Daphnia magna</i> was greater than 100 mg/L.
Chromium 7440-47-3	-	-	-	-
Nickel 7440-02-0	NOEC/EC10 values range from 12.3 µg/l for <i>Scenedesmus accuminatus</i>	The 96h LC50s values range from 0.4 mg Ni/L for <i>Pimephales promelas</i> to 320	The 30 min EC50 of nickel for activated sludge was 33 mg Ni/L.	The 48h LC50s values range from 0.013 mg Ni/L for <i>Ceriodaphnia dubia</i> to 4970

	to 425 µg/l for Pseudokirchneriella subcapitata.	mg Ni/L for Brachydanio rerio.		mg Ni/L for Daphnia magna.
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**Persistence and degradability****Bioaccumulation****Other adverse effects****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** None anticipated.

Chemical Name	RCRA - D Series Wastes
Chromium 7440-47-3	5.0 mg/L regulatory level

This product contains one or more substances that are listed with the State of California as a hazardous waste.

**14. TRANSPORT INFORMATION**

**DOT** Not regulated

**15. REGULATORY INFORMATION****International Inventories**

<b>TSCA</b>	Complies
<b>DSL/NDSL</b>	Complies
<b>EINECS/ELINCS</b>	Complies
<b>ENCS</b>	Complies
<b>IECSC</b>	Complies
<b>KECL</b>	Complies
<b>PICCS</b>	Does not comply
<b>AICS</b>	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

**US Federal Regulations****SARA 313**

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

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	No
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)

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Chromium 7440-47-3		X	X	
Nickel 7440-02-0		X	X	

**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)

Chemical Name	Hazardous Substances RQs
Chromium 7440-47-3	5000 lb
Nickel 7440-02-0	100 lb

**US State Regulations****California Proposition 65**

This product contains the following Proposition 65 chemicals

Chemical Name	California Proposition 65
Nickel - 7440-02-0	Carcinogen

**U.S. State Right-to-Know Regulations**

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Zirconium 7440-67-7	X	X	X
Hafnium 7440-58-6	X	X	X
Tin 7440-31-5	X	X	X
Molybdenum 7439-98-7	X	X	X
Chromium 7440-47-3	X	X	X
Nickel 7440-02-0	X	X	X

**U.S. EPA Label Information**

EPA Pesticide Registration Number Not applicable

**16. OTHER INFORMATION**

<b>NFPA</b>	Health hazards 0	Flammability 0	Instability 0	Physical and Chemical Properties -
<b>HMIS</b>	Health hazards 1	Flammability 0	Physical hazards 0	Personal protection X



Chronic Hazard Star Legend

\* = Chronic Health Hazard

**Issue Date** 28-May-2015

**Revision Date** 16-Sep-2016

**Revision Note**

Updated Section(s): 4, 9, 12

**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