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

Product identifier

Product Name
Nickel-Titanium Base Alloys

Other means of identification

Product Code
SAC013

Synonyms
All massive Nickel-Titanium alloys (product #490)

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
Company Phone Number 724-226-5980
Emergency Telephone 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)

<table>
<thead>
<tr>
<th>Hazard</th>
<th>Category</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute toxicity - Oral</td>
<td>Category 4</td>
</tr>
<tr>
<td>Skin sensitization</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>

Label elements

Emergency Overview

Danger

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

Appearance
Various massive product forms

Physical state
Solid

Odor
Odorless
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 occurs: Get medical advice/attention

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

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: titanium dioxide an IARC Group 2B carcinogen, Vanadium pentoxide (V2O5) affects eyes, skin, respiratory system. zinc, copper, magnesium, or cadmium fumes may cause metal fume fever.

### 3. COMPOSITION/INFORMATION ON INGREDIENTS

**Synonyms**
All massive Nickel-Titanium alloys (product #490).

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Weight-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>7440-02-0</td>
<td>35-60</td>
</tr>
<tr>
<td>Titanium</td>
<td>7440-32-6</td>
<td>20-50</td>
</tr>
<tr>
<td>Hafnium</td>
<td>7440-58-6</td>
<td>0-40</td>
</tr>
<tr>
<td>Niobium (Columbium)</td>
<td>7440-03-1</td>
<td>0-20</td>
</tr>
<tr>
<td>Copper</td>
<td>7440-50-8</td>
<td>0-15</td>
</tr>
<tr>
<td>Vanadium</td>
<td>7440-62-2</td>
<td>0-10</td>
</tr>
<tr>
<td>Iron</td>
<td>7439-89-6</td>
<td>0-6</td>
</tr>
<tr>
<td>Boron</td>
<td>19287-88-8</td>
<td>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 an allergic skin reaction see a physician.

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

**Ingestion**
Not an expected route of exposure.

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

**Symptoms**
May cause allergic skin reaction. May cause acute gastrointestinal effects if swallowed.

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

**Note to physicians**
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.

Unsafe 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.

Hazardous combustion products Titanium dioxide an IARC Group 2B carcinogen. Vanadium pentoxide (V2O5) affects eyes, skin, respiratory system. Zinc, copper, magnesium, or cadmium fumes may cause metal fumes fever.

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 See Section 12 for additional ecological information.

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 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.

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 flourine. When heated above 200°C, reacts exothermically with the following: chlorine, bromine, halocarbons, carbon
tetrachloride, carbon tetrachloride, freon.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH TLV</th>
<th>OSHA PEL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel</td>
<td>TWA: 1.5 mg/m³ inhalable fraction</td>
<td>TWA: 1 mg/m³</td>
</tr>
<tr>
<td>7440-02-0</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7440-32-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hafnium</td>
<td>TWA: 0.5 mg/m³ TWA: 0.5 mg/m³ Hf</td>
<td>TWA: 0.5 mg/m³</td>
</tr>
<tr>
<td>7440-58-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Niobium (Columbium)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7440-03-1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>TWA: 0.2 mg/m³ fume TWA: 1 mg/m³ Cu dust and mist</td>
<td>TWA: 0.1 mg/m³ fume TWA: 1 mg/m³ dust and mist</td>
</tr>
<tr>
<td>7440-50-8</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanadium</td>
<td>Ceiling: 0.5 mg/m³ V2O5 respirable dust Ceiling: 0.1 mg/m³ V2O5 fume</td>
<td>-</td>
</tr>
<tr>
<td>7440-62-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Iron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7439-89-6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Boron</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19287-88-8</td>
<td></td>
<td></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. 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 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>Odor Odor threshold Odorless Not Applicable</td>
</tr>
<tr>
<td>Appearance</td>
<td>Various massive product forms metallic, gray or silver</td>
<td></td>
</tr>
<tr>
<td>Color</td>
<td></td>
<td></td>
</tr>
<tr>
<td>pH</td>
<td>Not Applicable</td>
<td></td>
</tr>
<tr>
<td>Melting point/freezing point</td>
<td>1000 °C / 1860 °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 flammable in the form of this product as</td>
</tr>
<tr>
<td>Flammability (solid, gas)</td>
<td>-</td>
<td></td>
</tr>
</tbody>
</table>
Flammability Limit in Air
- Upper flammability limit: Not Applicable
- Lower flammability limit: Not Applicable

Vapor pressure - Not Applicable
Vapor density - Not Applicable
Specific Gravity 5.8-7.5
Water solubility Insoluble
Solubility in other solvents - 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
Oxidizing properties Not Applicable

Other Information
- Softening point Not Applicable
- Molecular weight Not Applicable
- VOC Content (%) Not Applicable
- Density -
- Bulk density 360-470 lb/ft³

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 flourine. When heated above 200°C, reacts exothermically with the following: chlorine, bromine, halocarbons, carbon tetrachloride, carbon tetrafluoride, 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. Titanium dioxide an IARC Group 2B carcinogen. Vanadium pentoxide (V2O5) affects eyes, skin, respiratory system.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

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 Nickel-containing alloys may cause sensitization by skin contact.
- Ingestion Not an expected route of exposure for product in massive form.
Information on toxicological effects

Symptoms
Nickel-containing alloys may cause sensitization by skin contact. May cause acute gastrointestinal effects if swallowed.

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

Acute toxicity
Harmful if swallowed.

Skin corrosion/irritation
Product not classified.

Serious eye damage/eye irritation
Product not classified.

Sensitization
Nickel-containing alloys may cause sensitization by skin contact.

Germ cell mutagenicity
Product not classified.

Carcinogenicity
May cause cancer by inhalation.

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.

12. ECOLOGICAL INFORMATION

Ecotoxicity
This product as shipped is not classified for aquatic toxicity.
| 7440-58-6 | dioxide in water to Danio rerio was greater than the solubility limit of 0.007 mg Hf/L. | dioxide to Daphnia magna was greater than the solubility limit of 0.007 mg Hf/L. |
| Niobium (Columbium) 7440-03-1 | - | - |
| Copper 7440-50-8 | The 72 h EC50 values of copper chloride to Pseudokirchneriella subcapitata ranged between 30 μg/L (pH 7.02, hardness 250 mg/L CaCO3, DOC 1.95 mg/L) and 824 μg/L (pH 6.22, hardness 100 mg/L CaCO3, DOC 15.8 mg/L). | The 96-hr LC50 for Pimephales promelas exposed to Copper sulfate ranged from 256.2 to 38.4 μg/L with water hardness increasing from 45 to 256.7 mg/L. | The 24 h NOEC of copper chloride for activated sludge ranged from 0.32 to 0.64 mg of Cu/L. | The 48 h LC50 values for Daphnia magna exposed to copper in natural water ranged between 33.8 μg/L (pH 6.1, hardness 12.4 mg/L CaCO3, DOC 2.34 mg/L) and 792 μg/L (pH 7.35, hardness 139.7 mg/L CaCO3, DOC 22.8 mg/L). |
| Vanadium 7440-62-2 | The 72 h EC50 of vanadium pentoxide to Desmodesmus subspicatus was 2,907 μg of V/L. | The 96 h LC50 of vanadium pentoxide to Pimephales promelas was 1,850 μg of V/L. | The 3 h EC50 of sodium metavanadate for activated sludge was greater than 100 mg/L. | The 48 h EC50 of sodium vanadate to Daphnia magna was 2,661 μg of V/L. |
| Iron 7439-59-6 | - | The 96 h LC50 of 50% iron oxide black in water to Danio rerio 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 Daphnia magna was greater than 100 mg/L. |
| Boron 12287-88-8 | - | - | - | - |

**Persistence and degradability**

**Bioaccumulation**

**Other adverse effects.**

This product as shipped is not classified for environmental endpoints. However, when subjected to sawing or grinding, particles may be generated that are classified for aquatic acute or aquatic chronic toxicity.

**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.

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

<table>
<thead>
<tr>
<th>Inventory</th>
<th>Compliance Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSCA</td>
<td>Complies</td>
</tr>
<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>Does not comply</td>
</tr>
<tr>
<td>AICS</td>
<td>Does not comply</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 - Korea 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: Chromium (Cr)

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>CAS No.</th>
<th>Weight-%</th>
<th>SARA 313 - Threshold Values %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nickel - 7440-02-0</td>
<td>7440-02-0</td>
<td>35-60</td>
<td>0.1</td>
</tr>
<tr>
<td>Copper - 7440-50-8</td>
<td>7440-50-8</td>
<td>0-15</td>
<td>1.0</td>
</tr>
</tbody>
</table>

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)

<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>Nickel</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7440-02-0</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td></td>
<td>X</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>7440-50-8</td>
<td></td>
<td></td>
<td></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>Nickel</td>
<td>100 lb</td>
</tr>
<tr>
<td>7440-02-0</td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>5000 lb</td>
</tr>
<tr>
<td>7440-50-8</td>
<td></td>
</tr>
</tbody>
</table>

US State Regulations

California Proposition 65
This product contains the following Proposition 65 chemicals
### 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>Nickel</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7440-02-0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>7440-32-8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hafnium</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7440-58-6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Copper</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7440-50-9</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vanadium</td>
<td>X</td>
<td>X</td>
<td>X</td>
</tr>
<tr>
<td>7440-62-2</td>
<td></td>
<td></td>
<td></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>Annual Update</td>
<td></td>
<td></td>
<td></td>
<td>Personal protection X</td>
</tr>
</tbody>
</table>

**HMIS**

<table>
<thead>
<tr>
<th>Health hazards</th>
<th>Flammability</th>
<th>Physical hazards</th>
</tr>
</thead>
<tbody>
<tr>
<td>2*</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Chronic Hazard Star Legend**

* = Chronic Health Hazard

**Issue Date**: 28-May-2015

**Revision Date**: 28-May-2015

**Revision Note**

Updated to comply with GHS

**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