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

1.1. Product identifier

Product Code: SAC014
Product Name: Vanadium and Vanadium Alloys
Synonyms: Vanadium and Vanadium Alloys (Product #986)

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

2.2. Label elements

Emergency Overview

<table>
<thead>
<tr>
<th>Appearance</th>
<th>Physical state</th>
<th>Odour</th>
</tr>
</thead>
<tbody>
<tr>
<td>Various massive product forms</td>
<td>Solid</td>
<td>Odourless</td>
</tr>
</tbody>
</table>

2.3. 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.
Hexavalent Chromium (Chromium VI) may cause lung, nasal, and/or sinus cancer.
Vanadium pentoxide (V2O5) affects eyes, skin, respiratory system.

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS
3.1 Substances

Synonyms
Vanadium and Vanadium Alloys, (Product #986).

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>EC No</th>
<th>CAS No</th>
<th>Weight-%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vanadium</td>
<td>231-171-1</td>
<td>7440-62-2</td>
<td>70-98</td>
</tr>
<tr>
<td>Chromium</td>
<td>231-157-5</td>
<td>7440-47-3</td>
<td>0-40</td>
</tr>
<tr>
<td>Titanium</td>
<td>231-142-3</td>
<td>7440-32-6</td>
<td>0-15</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
Not an expected route of exposure.

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
None in massive form, flammable as finely divided particles. 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. 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
Titanium dioxide, an IARC Group 2B carcinogen. Hexavalent Chromium (Chromium VI) may cause lung, nasal, and/or sinus cancer. Vanadium pentoxide (V2O5) affects eyes, skin, respiratory system.

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.

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
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. Ignores 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)
Not applicable.

Section 8: EXPOSURE CONTROLS/PERSOANL 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>Vanadium</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Skin</td>
</tr>
<tr>
<td>7440-62-2</td>
<td>TWA: 2 mg/m³</td>
<td>STEL: 1.5 mg/m³</td>
<td>TWA: 2 mg/m³</td>
<td>TWA: 2 mg/m³</td>
<td>TWA: 2 mg/m³</td>
</tr>
<tr>
<td>Chromium</td>
<td>TWA: 2 mg/m³</td>
<td>STEL: 1.5 mg/m³</td>
<td>TWA: 2 mg/m³</td>
<td>TWA: 2 mg/m³</td>
<td>TWA: 2 mg/m³</td>
</tr>
<tr>
<td>7440-47-3</td>
<td></td>
<td>TWA: 0.5 mg/m³</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Titanium</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>7440-32-6</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chemical Name</td>
<td>Italy</td>
<td>Portugal</td>
<td>Netherlands</td>
<td>Finland</td>
<td>Denmark</td>
</tr>
<tr>
<td>Vanadium</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><strong>Physical state</strong></td>
<td>Solid</td>
<td></td>
</tr>
<tr>
<td><strong>Appearance</strong></td>
<td>Various massive product forms</td>
<td></td>
</tr>
<tr>
<td><strong>Colour</strong></td>
<td>metallic, grey or Silver</td>
<td></td>
</tr>
<tr>
<td><strong>Odour</strong></td>
<td>Odourless</td>
<td></td>
</tr>
<tr>
<td><strong>Odour threshold</strong></td>
<td>Not applicable</td>
<td></td>
</tr>
<tr>
<td><strong>pH</strong></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Melting point/freezing point</strong></td>
<td>1580 °C / 2880 °F</td>
<td></td>
</tr>
<tr>
<td><strong>Boiling point / boiling range</strong></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Flash point</strong></td>
<td>-</td>
<td></td>
</tr>
<tr>
<td><strong>Evaporation rate</strong></td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Flammability (solid, gas)</strong></td>
<td>-</td>
<td>None in massive form, flammable as finely divided particles</td>
</tr>
<tr>
<td><strong>Flammability Limit in Air</strong></td>
<td></td>
<td></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><strong>Vapour pressure</strong></td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Vapour density</strong></td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Specific Gravity</strong></td>
<td>5.96</td>
<td>Insoluble</td>
</tr>
<tr>
<td><strong>Water solubility</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Solubility(ies)</strong></td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Partition coefficient</strong></td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Autoignition temperature</strong></td>
<td>-</td>
<td>Not applicable</td>
</tr>
<tr>
<td><strong>Decomposition temperature</strong></td>
<td>-</td>
<td>Not applicable</td>
</tr>
</tbody>
</table>
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

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. Hexavalent Chromium (Chromium VI) may cause lung, nasal, and/or sinus cancer. Vanadium pentoxide (V2O5) affects eyes, skin, respiratory system.

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: Product not classified.
- 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>
</table>
Information on toxicological effects

Symptoms

None known.

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

Product not classified.

Germ cell mutagenicity

Product not classified.

Carcinogenicity

Product not classified.

<table>
<thead>
<tr>
<th>Chemical Name</th>
<th>ACGIH</th>
<th>IARC</th>
<th>NTP</th>
<th>OSHA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chromium</td>
<td></td>
<td>Group 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7440-47-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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>Vanadium</td>
<td>The 72 h EC50 of vanadium pentoxide to Desmodesmus subspicatus was 2,907 ug of V/L.</td>
<td>The 96 h LC50 of vanadium pentoxide to Pimephales promelas was 1,850 ug of V/L.</td>
<td>The 3 h EC50 of sodium metavanadate for activated sludge was greater than 100 mg/L.</td>
<td>The 48 h EC50 of sodium vanadate to Daphnia magna was 2,661 ug of V/L.</td>
</tr>
<tr>
<td>Chromium</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Titanium</td>
<td>The 72 h EC50 of titanium dioxide to Pseudokirchnerella subcapitata was 61 mg of TiO2/L.</td>
<td>The 96 h LC50 of titanium dioxide to Cyprinodon varieguatus was greater than 10,000 mg of TiO2/L. The 96 h LC50 of titanium dioxide to Pimephales promelas was greater than 1,000 mg of TiO2/L.</td>
<td>The 3 h EC50 of titanium dioxide for activated sludge were greater than 1000 mg/L.</td>
<td>The 48 h EC50 of titanium dioxide to Daphnia Magna was greater than 1000 mg of TiO2/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

<table>
<thead>
<tr>
<th>Waste from residues/unused products</th>
<th>Disposal should be in accordance with applicable regional, national and local laws and regulations.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contaminated packaging</td>
<td>None anticipated.</td>
</tr>
</tbody>
</table>

---

### 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
- **14.5 Environmental hazard**: Not applicable
- **14.6 Special Provisions**: None

**IATA**

- **14.1 UN/ID no**: Not regulated
- **14.2 Proper shipping name**: Not regulated
- **14.3 Hazard Class**: Not regulated
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>Vanadium</td>
<td>RG 66</td>
<td>-</td>
</tr>
<tr>
<td>7440-62-2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chromium</td>
<td>RG 10</td>
<td>-</td>
</tr>
<tr>
<td>7440-47-3</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>
</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: Complies

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: 05-Jan-2017
Revision Note: Updated Section(s): 1, 5, 6, 7.

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