SAFETY DATA SHEET

Issue Date 28-May-2015 **Revision Date** 07-May-2020 **Version** 6

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

1.1. Product identifier

Product Code SAC008
Product Name Titanium and Titanium Alloys

Synonyms Titanium and Titanium Alloys: All Titanium Base Alloys, (Product # 833)

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
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

Not Hazardous Not a hazardous substance or mixture according to the Globally Harmonised System (GHS)

2.2. Label elements

Emergency Overview

Appearance Various massive product forms **Physical state** Solid **Odour** Odourless

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. Soluble molybdenum compounds such as molybdenum trioxide may cause lung irritation.

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms Titanium and Titanium Alloys: All Titanium Base Alloys, (Product # 833).

Chemical Name	EC No	CAS No	Weight-%
Titanium	231-142-3	7440-32-6	50->99
Vanadium	231-171-1	7440-62-2	0-45
Molybdenum	231-107-2	7439-98-7	0-37
Zirconium	231-176-9	7440-67-7	0-35
Chromium	231-157-5	7440-47-3	0-18
Niobium	231-113-5	7440-03-1	0-15
Tin	231-141-8	7440-31-5	0-8
Aluminium	231-072-3	7429-90-5	0-8
Silicon	231-130-8	7440-21-3	0-3

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: FIREFIGHTING 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. Isolate large fires and allow to burn out. Smother small fires 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. 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.

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. Soluble molybdenum compounds such as molybdenum trioxide may cause lung irritation.

5.3. Advice for firefighters

Firefighters should wear self-contained breathing apparatus and full firefighting turnout 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
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. 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.

7.3. Specific end use(s)

Risk Management Methods (RMM)
Not required.

Section 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Chemical Name	European Union	United Kingdom	France	Spain	Germany
Titanium 7440-32-6	-	-	-	-	-
Vanadium 7440-62-2	-	-	-	-	Skin
Molybdenum 7439-98-7	-	-	-	TWA: 10 mg/m³ TWA: 3 mg/m³	-
Zirconium 7440-67-7	-	TWA: 5 mg/m³	-	STEL: 10 mg/m³ TWA: 5 mg/m³	TWA: 1 mg/m³ Ceiling / Peak: 1 mg/m³
Chromium 7440-47-3	TWA: 2 mg/m³	STEL: 1.5 mg/m³ TWA: 0.5 mg/m³	TWA: 2 mg/m³	TWA: 2 mg/m³	TWA: 2 mg/m³
Niobium 7440-03-1	-	-	-	-	-
Tin 7440-31-5	TWA 2 mg/m³ as Sn	TWA: 2 mg/m³	-	TWA: 2 mg/m³	-
Aluminium 7429-90-5	-	STEL: 30 mg/m³ STEL: 12 mg/m³ TWA: 10 mg/m³ TWA: 4 mg/m³	TWA: 10 mg/m³ TWA: 5 mg/m³	TWA: 10 mg/m³ TWA: 5 mg/m³	TWA: 4 mg/m³ TWA: 1.5 mg/m³
Silicon 7440-21-3	-	STEL: 30 ppm STEL: 12 mg/m³ TWA: 10 mg/m³ TWA: 4 mg/m³	TWA: 10 mg/m³	-	-

Chemical Name	Italy	Portugal	Netherlands	Finland	Denmark
Titanium 7440-32-6	-	-	-	-	-
Vanadium 7440-62-2	-	-	-	-	-
Molybdenum 7439-98-7	-	TWA: 10 mg/m³ TWA: 3 mg/m³	-	TWA: 0.5 mg/m³	-
Zirconium 7440-67-7	-	STEL: 10 mg/m³ TWA: 5 mg/m³	-	TWA: 1 mg/m³	TWA: 5 mg/m³
Chromium 7440-47-3	TWA: 0.5 mg/m³	TWA: 0.5 mg/m³	TWA: 0.5 mg/m³	TWA: 0.5 mg/m³	TWA: 0.5 mg/m³
Niobium 7440-03-1	-	-	-	-	TWA: 5 mg/m³ TWA: 0.5 mg/m³
Tin 7440-31-5	-	TWA: 2 mg/m³	-	TWA: 2 mg/m³	TWA: 2 mg/m³
Aluminium 7429-90-5	-	TWA: 10 mg/m³ TWA: 5 mg/m³	TWA: 0.05 mg/m³	TWA: 1.5 mg/m³	TWA: 5 mg/m³ TWA: 2 mg/m³
Silicon 7440-21-3	-	-	-	-	TWA: 10 mg/m³

Chemical Name	Austria	Switzerland	Poland	Norway	Ireland
Titanium 7440-32-6	-	-	STEL: 30 mg/m³ TWA: 10 mg/m³	-	-
Vanadium 7440-62-2	STEL 1 mg/m³ TWA: 0.5 mg/m³	-	-	TWA: 0.2 mg/m³ Ceiling: 0.05 mg/m³ STEL: 0.6 mg/m³	-
Molybdenum 7439-98-7	STEL 20 mg/m³ TWA: 10 mg/m³	TWA: 10 mg/m³	STEL: 10 mg/m³ TWA: 4 mg/m³	-	TWA: 0.5 mg/m³
Zirconium 7440-67-7	TWA: 5 mg/m³	TWA: 5 mg/m³	STEL: 10 mg/m³ TWA: 5 mg/m³	TWA: 5 mg/m³ STEL: 10 mg/m³	TWA: 5 mg/m³ STEL: 10 mg/m³
Chromium 7440-47-3	TWA: 2 mg/m³	TWA: 0.5 mg/m³	TWA: 0.5 mg/m³	TWA: 0.5 mg/m³ STEL: 1.5 mg/m³	TWA: 2 mg/m³
Niobium 7440-03-1	STEL 10 mg/m³ STEL 1 mg/m³ TWA: 5 mg/m³ TWA: 0.5 mg/m³	-	-	-	-
Tin 7440-31-5	STEL 4 mg/m³ TWA: 2 mg/m³	Skin STEL: 4 mg/m³ TWA: 2 mg/m³	TWA: 2 mg/m³	TWA: 2 mg/m³ STEL: 4 mg/m³	TWA: 2 mg/m³
Aluminium 7429-90-5	STEL 20 mg/m³ TWA: 10 mg/m³	TWA: 3 mg/m³	TWA: 2.5 mg/m³ TWA: 1.2 mg/m³	TWA: 5 mg/m³ STEL: 10 mg/m³	TWA: 1 mg/m³ TWA: 5 mg/m³
Silicon 7440-21-3	-	TWA: 3 mg/m³	-	TWA: 10 mg/m³ STEL: 20 mg/m³	TWA: 10 mg/m³ TWA: 4 mg/m³

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 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 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

Physical state	Solid		
Appearance	Various massive product forms	**Odour**	Odourless
Colour	Metallic grey or Silver	**Odour threshold**	Not applicable

Property	**Values**	**Remarks • Method**
pH	-	Not applicable
Melting point / freezing point	1850 °C / 3370 °F	
Boiling point / boiling range	-	
Flash point	-	
Evaporation rate	-	Not applicable
Flammability (solid, gas)	-	Product not flammable in the form as distributed, flammable as finely divided particles or pieces resulting from processing of this product
Flammability Limit in Air		
Upper flammability limit:		-
Lower flammability limit		-
Vapour pressure	-	Not applicable
Vapour density	-	Not applicable
Specific Gravity	6.49	
Water solubility	Insoluble	
Solubility(ies)		
Partition coefficient	-	Not applicable
Autoignition temperature	-	Not applicable
Decomposition temperature	-	Not applicable
Kinematic viscosity	-	Not applicable
Dynamic viscosity	-	Not applicable
Explosive properties	Not applicable	
Oxidising properties	Not applicable	

9.2. Other information

Softening point	-
Molecular weight	-
VOC Content (%)	Not applicable
Density	-
Bulk density	-

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. 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 (V_2O_5) affects eyes, skin, respiratory system. Soluble molybdenum compounds such as molybdenum trioxide may cause lung irritation.

Section 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Product Information

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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.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Titanium	> 5000 mg/kg bw	-	-
Vanadium	> 2000 mg/kg bw	-	-
Molybdenum	> 2000 mg/kg bw	> 2000 mg/kg bw	> 5.10 mg/L
Zirconium	5000 mg/kg bw	-	>4.3 mg/L
Chromium	> 3400 mg/kg bw	-	> 5.41 mg/L
Niobium	> 10,000 mg/kg bw	> 2000 mg/kg bw	-
Tin	> 2000 mg/kg bw	> 2000 mg/kg bw	> 4.75 mg/L
Aluminium	15,900 mg/kg bw	-	> 1 mg/L
Silicon	> 5000 mg/kg bw	> 5000 mg/kg bw	> 2.08 mg/L

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.

Chemical Name	ACGIH	IARC	NTP	OSHA
Chromium 7440-47-3		Group 3		

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

Chemical Name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Titanium	The 72 h EC50 of titanium dioxide to Pseudokirchnerella subcapitata was 61 mg of TiO2/L.	The 96 h LC50 of titanium dioxide to Cyprinodon variegatus 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 .	The 3 h EC50 of titanium dioxide for activated sludge were greater than 1000 mg/L.	The 48 h EC50 of titanium dioxide to Daphnia Magna was greater than 1000 mg of TiO2/L.
Vanadium	The 72 h EC50 of vanadium pentoxide to Desmodesmus subspicatus was 2,907 ug of V/L.	The 96 h LC50 of vanadium pentoxide to Pimephales promelas was 1,850 ug 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 ug of V/L.
Molybdenum	The 72 h EC50 of sodium molybdate dihydrate to Pseudokirchneriella subcapitata was 362.9 mg of Mo/L.	The 96 h LC50 of sodium molybdate dihydrate to Pimephales promelas 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 Ceriodaphnia dubia was 1,015 mg/L. The 48 h LC50 of sodium molybdate dihydrate to Daphnia magna was greater than 1,727.8 mg/L.
Zirconium	The 14 d NOEC of zirconium dichloride oxide to Chlorella vulgaris was greater than 102.5 mg of Zr/L.	The 96 h LL50 of zirconium to Danio rerio was greater than 74.03 mg/L.	-	The 48 h EC50 of zirconium dioxide to Daphnia magna was greater than 74.03 mg of Zr/L.
Chromium	-	-	-	-

Niobium	-	-	-	-
Tin	The 72 h EC50 of tin chloride pentahydrate to Pseudokirchnerella subcapitata was 9,846 ug of Sn/L	The 7 d LOEC of tin chloride pentahydrate to Pimephales promelas was 827.9 ug of Sn/L	-	The 7 d LC50 of tin chloride pentahydrate to Ceriodaphnia dubia was greater than 3,200 ug of Sn/L.
Aluminium	The 96-h EC50 values for reduction of biomass of Pseudokirchneriella subcapitata in AAP-Medium at pH 6, 7, and 8 were estimated as 20.1, 5.4, and 150.6 µg/L, respectively, for dissolved Al.	The 96 h LC50 of aluminum to Oncorhynchus mykiss was 7.4 mg of Al/L at pH 6.5 and 14.6 mg of Al/L at pH 7.5	-	The 48-hr LC50 for Ceriodaphnia dubia exposed to Aluminium chloride increased from 0.72 to greater than 99.6 mg/L with water hardness increasing from 25 to 200 mg/L.
Silicon	The 72 h EC50 of sodium metasilicate pentahydrate to Pseudokirchnerella subcapitata was greater than 250 mg/L.	-	-	-

12.2. Persistence and degradability

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12.3. Bioaccumulative potential

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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 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
14.4 Packing Group	Not regulated
Description	Not applicable
14.5 Environmental hazard	Not applicable
14.6 Special Provisions	None

Section 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Chemical Name	French RG number	Title
Titanium 7440-32-6	-	-
Vanadium 7440-62-2	RG 66	-
Molybdenum 7439-98-7	-	-
Zirconium 7440-67-7	-	-
Chromium 7440-47-3	RG 10	-
Niobium 7440-03-1	-	-
Tin 7440-31-5	-	-
Aluminium 7429-90-5	RG 32 RG 16,RG 16bis	-
Silicon 7440-21-3	-	-

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	Not Listed
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	07-May-2020
Revision Note	SDS sections updated: 5, 9, 12, 15, 16.

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