

PRESIDENT TITANIUM CO., INC.



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SAFETY DATA SHEET

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

Product Identifier / Product Name: Titanium & Titanium Alloys

Other means of identification: 6AL/4V Grade 5 / 6AL/4V Grade 23 (ELI) / CP-Grade 4 / CP-Grade 2

Recommended Use: Titanium & Titanium Alloy product manufacture (i.e. forging, casting, welding, cutting, etc. for aerospace, medical, military, and/or commercial applications).

Recommended Restrictions: None

Distributor Information: President Titanium Co., Inc. – 243 Franklin Street – Hanson, MA 02341 U.S.A.
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Emergency Information: 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

Appearance	Physical State	Odor
various product forms	solid	odorless

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, zinc, copper, magnesium, or cadmium fumes may cause metal fume fever, Soluble molybdenum compounds such as molybdenum trioxide may cause lung irritation.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms (partial list):

6/4 Gr.5 Titanium, 6/4 ELI (Gr.23) Titanium, CP-Gr.4 Titanium, CP-Gr.2 Titanium, ATI 6-4™ Alloy, ATI 6-4 ELI™ Alloy, ATI CP Grade 2, ATI CP Grade 4, TIMETAL 6-4, TIMETAL 6-4 ELI, TIMETAL CP Grade 2, TIMETAL CP Grade 4

Chemical Name	CAS No.	Weight-%
Titanium	7440-32-6	50 - 100
Aluminum	7429-90-5	0 - 40
Molybdenum	7439-98-7	1 - 15
Chromium	7440-47-3	0 - 10
Niobium (Columbium)	7440-03-1	0 - 10
Vanadium	7440-62-2	0 - 10
Zirconium	7440-67-7	0 - 10
Tin	7440-31-5	0 - 5
Copper	7440-50-8	0 - 5
Iron	7439-89-6	0 - 5
Silicon	7440-21-3	0 - 1
Nickel	7440-02-0	0-0.9

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

Note to physicians	Treat symptomatically.
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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.

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, zinc, copper, magnesium, or cadmium fumes may cause metal fume fever. 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.

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
Titanium 7440-32-6		
Aluminum 7429-90-5	TWA: 1 mg/m ³ respirable fraction	TWA: 15 mg/m ³ total dust TWA: 5 mg/m ³ respirable fraction
Molybdenum 7439-98-7	TWA: 10 mg/m ³ inhalable fraction TWA: 3 mg/m ³ respirable fraction	
Chromium 7440-47-3	TWA: 0.5 mg/m ³	TWA: 1 mg/m ³
Niobium (Columbium) 7440-03-1		
Vanadium 7440-62-2		Ceiling: 0.5 mg/m ³ V ₂ O ₅ respirable dust Ceiling: 0.1 mg/m ³ V ₂ O ₅ fume
Zirconium 7440-67-7	STEL: 10 mg/m ³ / STEL: 10 mg/m ³ Zr TWA: 5 mg/m ³ / TWA: 5 mg/m ³ Zr	TWA: 5 mg/m ³ Zr (vacated) STEL: 10 mg/m ³ / (vacated) STEL: 10 mg/m ³ Zr
Tin 7440-31-5	TWA: 2 mg/m ³ TWA: 2 mg/m ³ Sn except Tin hydride	TWA: 2 mg/m ³ Sn except oxides

Copper 7440-50-8	TWA: 0.2 mg/m ³ fume TWA: 1 mg/m ³ Cu dust and mist	TWA: 0.1 mg/m ³ fume TWA: 1 mg/m ³ dust and mist
Iron 7439-89-6		
Silicon 7440-21-3		TWA: 15 mg/m ³ total dust TWA: 5 mg/m ³ respirable fraction
Nickel 7440-02-0	TWA: 1.5 mg/m ³ inhalable fraction	TWA: 1 mg/m ³

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/flammable resistant/retardant clothing may be appropriate during hot work with the product. Wear protective gloves. 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

Physical state	Solid	Odor	Odorless
Appearance	Various massive product forms	Odor threshold	Not applicable
Color	metallic, gray or silver		

<u>Property</u>	<u>Values</u>	<u>Remarks * Method</u>
Ph	Not applicable	
Melting point/freezing point	1540-1670 °C 2800-3000 °F	
Boiling point / boiling range	-----	Not applicable
Flash point	-----	Not applicable
Evaporation rate	-----	Not applicable
Flammability (solid, gas)	-----	Not flammable in the form of this product as distributed, flammable as finely divided particles or pieces resulting from processing of this product
Flammability Limit in Air		
Upper flammability limit:	Not applicable	
Lower flammability limit:	Not applicable	
Vapor pressure	-----	Not applicable
Vapor density	-----	Not applicable
Specific Gravity	4.5	
Water solubility	Insoluble	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	-----

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:

- 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

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 or Cobalt containing alloys may cause sensitization by skin contact.
- Ingestion Not an expected route of exposure for product in massive form.

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Titanium 7440-32-6	> 5000 mg/kg bw	--	--
Aluminum 7429-90-5	15,900 mg/kg bw	--	> 1 mg/L
Molybdenum 7439-98-7	> 2000 mg/kg bw	> 2000 mg/kg bw	> 5.10 mg/L
Zirconium 7440-67-7	5000 mg/kg bw	--	> 4.3 mg/L
Vanadium 7440-62-2	> 2000 mg/kg bw	--	--
Niobium (Columbium) 7440-03-1	--	> 2000 mg/kg bw	--
Chromium 7440-47-3	> 3400 mg/kg bw	--	> 5.41 mg/L
Tin 7440-31-5	> 2000 mg/kg bw	> 2000 mg/kg bw	> 4.75 mg/L
Iron 7439-89-6	98,600 mg/kg bw	--	> 0.25 mg/L
Copper 7440-50-8	481 mg/kg bw	> 2000 mg/kg bw	> 5.11 mg/L

Silicon 7440-21-3	> 5000 mg/kg bw	> 5000 mg/kg bw	> 2.08 mg/L
Nickel 7440-02-0	> 9000 mg/kg bw	--	--

Information on toxicological effects

- Symptoms** Nickel or Cobalt containing alloys 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	Nickel or Cobalt containing alloys 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 contains a chemical which is listed as a severe marine pollutant according to DOT

Chemical Name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Titanium 7440-32-6	The 72 h EC50 of titanium dioxide to <i>Pseudokirchnerella subcapitata</i> was 61 mg of TiO ₂ /L	The 96 h LC50 of titanium dioxide to <i>Cyprinodon variegatus</i> was greater than 10,000 mg of TiO ₂ /L. The 96 h LC50 of titanium dioxide to <i>Pimephales promelas</i> was greater than 1,000 mg of TiO ₂ /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 <i>Daphnia Magna</i> was greater than 1000 mg of TiO ₂ /L
Aluminum 7429-90-5	The 96-h EC50 values for reduction of biomass of <i>Pseudokirchneriella subcapitata</i> 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 <i>Oncorhynchus mykiss</i> 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 <i>Ceriodaphnia dubia</i> 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
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
Chromium 7440-47-3	--	--	--	--

Niobium (Columbium) 7440-03-1	--	--	--	--
Vanadium 7440-62-2	The 72 h EC50 of vanadium pentoxide to <i>Desmodesmus subspicatus</i> was 2,907 ug of V/L	The 96 h LC50 of vanadium pentoxide to <i>Pimephales promelas</i> 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 <i>Daphnia magna</i> was 2,661 ug of V/L
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
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
Copper 7440-50-8	The 72 h EC50 values of copper chloride to <i>Pseudokirchneriella subcapitata</i> ranged between 30 µg/L (pH 7.02, hardness 250 mg/L CaCO ₃ , DOC 1.95 mg/L) and 824 µg/L (pH 6.22, hardness 100 mg/L CaCO ₃ , DOC 15.8 mg/L)	The 96-hr LC50 for <i>Pimephales promelas</i> exposed to Copper sulfate ranged from 256.2 to 38.4 ug/L with water hardness increasing from 45 to 255.7 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 <i>Daphnia magna</i> exposed to copper in natural water ranged between 33.8 µg/L (pH 6.1, hardness 12.4 mg/L CaCO ₃ , DOC 2.34 mg/L) and 792 µg/L (pH 7.35, hardness 139.7 mg/L CaCO ₃ , DOC 22.8 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
Silicon 7440-21-3	The 72 h EC50 of sodium metasilicate pentahydrate to <i>Pseudokirchnerella subcapitata</i> was greater than 250 mg/L	--	--	--
Nickel 7440-02-0	NOEC/EC10 values range from 12.3 µg/l for <i>Scenedesmus accuminatus</i> to 425 µg/l for <i>Pseudokirchneriella subcapitata</i>	The 96h LC50s values range from 0.4 mg Ni/L for <i>Pimephales promelas</i> to 320 mg Ni/L for <i>Brachydanio rerio</i>	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 mg Ni/L for <i>Daphnia magna</i>

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**

TSCA	Complies
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

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 - 10	1.0
Copper 7440-50-8	7440-50-8	0 - 5	1.0
Nickel 7440-02-0	7440-02-0	0 - 0.9	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	
Copper 7440-50-8		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.
Copper 7440-50-8	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
Titanium 7440-32-6	X		
Aluminum 7429-90-5	X	X	X
Molybdenum 7439-98-7	X	X	X
Zirconium 7440-67-7	X	X	X
Vanadium 7440-62-2	X	X	X
Chromium 7440-47-3	X	X	X
Tin 7440-31-5	X	X	X
Copper 7440-50-8	X	X	X
Silicon 7440-21-3	X	X	X
Nickel 7440-02-0	X	X	X

U.S. EPA Label Information

EPA Pesticide Registration Number

Not applicable

16. OTHER INFORMATION

NFPA Health hazards – 0 Flammability – 0 Instability – 0 Physical and Chemical Properties – n/a
HMIS Health hazards – 1* Flammability – 0 Physical Hazards – 0 Personal Protection – X
Chronic Hazard Star Legend * = Chronic Health Hazard

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.