Titanium Alloy

Safety Data Sheet

Section 1: Identification

1.1 Product Identifier

Product Name:	Titanium Alloy
Product Form:	Solid
Chemical Family:	Metal Alloy
CAS Number:	No CAS number assigned. See **Section 3.2** for component CAS numbers.
Molecular Formula:	See **Section 3.1**.
Molecular Weight:	Varies. See **Section 3.1**.

1.2 Other Means of Identification

Synonyms:	ERTi-1, ERTi-2, ERTi-3, ERTi-4, ERTi-5 (6AL/4V), ERTi-5ELI (6AL/4V ELI), ERTi-7, ERTi-12

1.3 Recommended Uses

Recommended Use:	Variety of laboratory, mechanical, and industrial applications

1.4 Manufacturer, Importer, or Responsible Party

Responsible Party:	Defense Logistics Agency Strategic Materials 8725 John J. Kingman Road Fort Belvoir, Virginia 22060 (703) 767-5525

1.5 Emergency Phone Number

Emergency Phone Number:	(800) 424-9300 (CHEMTREC) (703) 527-3887 (CHEMTREC INTERNATIONAL)

Section 2: Hazard(s) Identification

2.1 Classification of Chemical per OSHA CFR 1910.1200

Eye Irritation:	Category 2B
Respiratory Sensitization:	Category 1A
Carcinogen:	Category 2

2.2 Label Elements

Signal Word: DANGER

Symbol(s):

Hazard Statements: Causes eye irritation. May cause allergy or asthma symptoms or breathing difficulties if inhaled. Suspected of causing cancer (when Titanium alloyed with Nickel and/or Chromium).

Precautionary Statements:	Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Wear protective gloves, protective clothes, eye protection, and face protection. Avoid breathing dust or fumes. Wash hands and exposed skin thoroughly after handling. In case of inadequate ventilation, wear respiratory protection. Response: If in eyes, rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If inhaled, and breathing is difficult, remove person to fresh air and keep comfortable for breathing. If experiencing respiratory symptoms, or if eye irritation persists, call a poison control center or get medical attention. If exposed or concerned, get medical attention. Storage: Store locked up. Disposal: Dispose of contents in accordance with federal, state, and local regulations.

2.3 Other Hazards

Prolonged, repeated exposure to fumes or dusts generated during cutting, grinding, or welding may cause adverse health effects associated with the following constituents:

Aluminum:	Not generally regarded as serious industrial health hazard.
Chromium:	The dusts of chromium metal are usually reported to be relatively nontoxic, although there are reports of skin ulcers, usually on hands, or a perforated nasal septum. Some insoluble chromium compounds are suspect carcinogens.
Columbium (Niobium):	No reports of human intoxication.
Iron:	Siderosis, no fibrosis.
Molybdenum:	Irritation to the nose and throat, weight loss, and digestive disturbances in animals. No industrial poisoning has been reported.
Nickel:	Respiratory irritation and pneumonitis. Several nickel oxides are suspect lung and nasal carcinogens.
Tantalum:	No systemic effects from industrial exposure have been reported in humans.
Tin:	Dust of tin oxides has caused a pneumonoconiosis, which is relatively benign.
Titanium:	Generally considered to be in the nuisance dust category.
Vanadium:	Irritant to the conjunctive and respiratory tract. May lead to pulmonary involvement. Signs and symptoms of poisoning are pallor, greenish-black discoloration of the tongue, cough, conjunctivitis, pain in the chest, bronchitis, rales and rhonchi, bronchospasm, tremor of the fingers and arms, and radiographic reticulation.
Zirconium:	Studies of several zirconium compounds conclude that zirconium is an element of low toxicity.

Note: Some fume constituents pose more potential hazards than others, depending upon their inherent toxicity and concentration. Of special concern are chromium, vanadium, nickel, and possible titanium. It is advised that your particular operation be evaluated by a health professional to determine whether or not a hazard exists.

Arc Rays can injure eyes and burn skin. Electric shock can kill.

2.4 Unknown Acute Toxicity

Does not apply to this product.

Section 3: Composition / Information on Ingredients

3.1 Chemical Name

Chemical Name:	Titanium Alloy

Composition:

Ingredients	CAS No.	% Weight
Aluminum	7429-90-5	0 – 8
Chromium	7440-47-3	0 – 11
Columbium (Niobium)	7440-03-1	0 – 2
Iron	7439-89-6	0 – 2
Molybdenum	7439-98-7	0 – 11.5
Nickel	7440-02-0	0 – 0.9
Tantalum	7440-25-7	0 – 1
Tin	7440-31-5	0 – 4.5
Titanium	7440-32-6	73 – 99
Vanadium	7440-62-2	0 – 13
Zirconium	7440-67-7	0 – 6

3.2 Common Names/Synonyms

Synonyms: See **Section 1.2** for common names and synonyms.

3.3 CAS Number/Unique Identifiers

CAS Number: 7440-32-6 (for pure Titanium)

See **Section 3.1** for additional alloy constituents and related CAS Numbers.

3.4 Impurities/Stabilizing Additives

No data available.

Section 4: First-Aid Measures

4.1 Description of First-Aid Measures

Get medical assistance. Use first aid procedures recommended by the American Red Cross. If breathing is difficult, give oxygen. If not breathing, use CPR. Consult a physician if irritation of the eyes and skin or flash burns develop after exposure.

4.2 Most Important Symptoms/Effects, both Acute and Delayed

Inhalation (Acute): Overexposure to welding fumes may result in discomfort such as dizziness, nausea, or dryness or irritation of nose, throat, or eyes. Inhalation of extremely high levels of fluorides may cause abdominal pain, diarrhea, muscular weakness and convulsions.

Inhalation (Chronic): Continued inhalation could cause loss of consciousness and death.

Skin Contact (Acute): Arc rays can burn skin.

Skin Contact (Chronic): No data available.

Eye Contact (Acute): Arc rays can injure eyes.

Eye Contact (Chronic): No data available.

Ingestion (Acute): No data available.

Ingestion (Chronic): No data available.

4.3 Indication of Immediate Medical Attention/Special Treatment

No data available.

Section 5: Fire Fighting Measures

5.1 Suitable Extinguishing Media

Dry table salt or Type D fire extinguisher. Do not use water or carbon dioxide to extinguish. In airtight enclosures, titanium fires can be controlled by the use of argon or helium.

5.2 Specific Hazards

Dry titanium burns slowly while releasing much heat. Water applied to burning titanium may cause an explosion. Piled chips may burn vigorously.

5.3 Special Protective Equipment and Precautions

Remove uninvolved material and allow fire to burn out. Fire can be controlled by covering with dry salt or powder from Type D extinguisher. Carbon dioxide is not effective.

Section 6: Accidental Release Measures

6.1 Personal Precautions, Protective Equipment, and Emergency Procedures

Keep unauthorized people away, isolate hazard area, and deny entry. Keep out of water supplies and sewers. Keep sparks, flames, and other sources of ignition away.

6.2 Methods and Materials for Containment and Cleaning Up

Collect spilled material in appropriate container for disposal.

Section 7: Handling and Storage

7.1 Precautions for Safe Handling

Handle in accordance with all current regulations and standards. Adequate ventilation and lubrication should be provided during sawing, grinding, and polishing of titanium metal.

7.2 Conditions for Safe Storage

Store in accordance with all current regulations and standards.

Section 8: Exposure Controls / Personal Protection

8.1 Exposure Limits

The ACGIH recommended general limit for welding fume NOC (not otherwise classified) is 5 mg/m^3. ACGIH-1985 preface states: "The TLC-TWA should be used as guides in the control of health hazards and should not be used as fine lines between safe and dangerous concentrations." The following are specific fume PEL and TLV, if any:

Aluminum:	
OSHA PEL:	15 mg/g^3 (Total Dust) 5 mg/m^3 (Respirable Fraction)
ACGIH TLV:	5 mg/m^3
Chromium:	
OSHA PEL:	0.5 mg/m^3
ACGIH TLV:	0.5 mg/m^3
Columbium (Niobium):	
OSHA PEL:	15 mg/g^3 (Total Dust) 5 mg/m^3 (Respirable Fraction)
ACGIH TLV:	None
Iron:	
OSHA PEL:	10 mg/m^3 (as Fe_2O_3 fume)
ACGIH TLV:	5 mg/m^3
Molybdenum:	
OSHA PEL:	5 mg/m^3 (soluble compounds)
ACGIH TLV:	5 mg/m^3 (soluble compounds)

Nickel:	
OSHA PEL:	1 mg/m^3
ACGIH TLV:	0.1 mg/m^3 (soluble Ni compounds)
Tantalum:	
OSHA PEL:	5 mg/m^3
ACGIH TLV:	10 mg/m^3
Tin:	
OSHA PEL:	2 mg/m^3
ACGIH TLV:	2 mg/m^3
Titanium:	
OSHA PEL:	15 mg/g^3 (Total Dust) 5 mg/m^3 (Respirable Fraction)
ACGIH TLV:	10 mg/m^3 (as TiO_2)
Vanadium:	
OSHA PEL:	0.5 mg/m^3 (dust), 0.1 mg/m^3 (fume)
ACGIH TLV:	0.05 mg/m^3 (as V_3O_5)
Zirconium:	
OSHA PEL:	5 mg/m^3
ACGIH TLV:	5 mg/m^3

8.2 Appropriate Engineering Controls

Ventilation: Use plenty of ventilation and/or local exhaust at the arc, to keep the fumes and gases below the threshold limit value within the worker's breathing zone and the general work area. Welders should be advised to keep their head out of the fumes.

8.3 Individual Protection Measures

Eye Protection: Wear a helmet or face shield with filter lens shade number 12-14 or darker. Shield other workers by providing screens and flash goggles.

Clothing: Wear approved head, hand, and body protection, which help to prevent injury from radiation, sparks, and electrical shock. See ANSI Z-41.1. This would include wearing welder's gloves and a protective face shield and may include arm protectors, apron, hats, shoulder protection, as well as dark substantial clothing. Welders should be trained not to allow electrically live parts to contact the skin or wet clothing and gloves. The welders should insulate themselves from the work and ground.

Respirator: Use respirable fume respirator or air supplied respirator when welding in a confined space or general work area where local exhaust and/or ventilation does not keep exposure below the threshold limit value.

Section 9: Physical and Chemical Properties

9.1 Appearance

Physical State: Solid

Physical Description: Gray, dark gray, lustrous metallic solid. Brittle when cold, malleable when hot, ductile only when free of oxygen.

9.2 Odor

Odorless.

9.3 Odor Threshold

No data available.

9.4 pH
No data available.

9.5 Melting/Freezing Points

Melting Point:	3,034ºF (1,668ºC)
Freezing Point:	No data available.

9.6 Initial Boiling Point and Boiling Range

Boiling Point:	5,948ºF (3,287ºC)

9.7 Flash Point
No data available.

9.8 Evaporation Rate
No data available.

9.9 Flammability
No data available.

9.10 Upper/Lower Explosive Limits
No data available.

9.11 Vapor Pressure

Vapor Pressure:	1.0 x 10^{-79} atm @ 77°F (25ºC)

9.12 Vapor Density
No data available.

9.13 Relative Density

Water = 1	4.5

9.14 Solubility(ies)

Soluble:	Dilute Acids
Insoluble:	Water

9.15 Partition Coefficient
No data available.

9.16 Auto-Ignition Temperature

Metal in Air:	2,200ºF (1,200ºC)
Powder in Air:	480ºF (250ºC)

9.17 Decomposition Temperature
No data available.

9.18 Viscosity
No data available.

Section 10: Stability and Reactivity

10.1 Reactivity
Reacts with fluorine @ 302ºF (150ºC), with chlorine @ 572ºF (300ºC), with bromine @ 680ºF (360ºC), with iodine above 680ºF (360ºC).

10.2 Chemical Stability
Stable.

10.3 Possibility of Hazardous Reactions

Acids:	Attacked only on heating.
Nitric Acid:	Oxidizing reaction.
Oxygen:	Combines @ red heat.

10.4 Conditions to Avoid

Avoid open flames and heat.

10.5 Incompatible Materials

Materials to Avoid:	Strong oxidizing or reducing agents.

Safe storage of the material is discussed in **Section 7.2**.

10.6 Hazardous Decomposition Products

No data available.

Section 11: Toxicological Information

11.1 Likely Routes of Exposure

Welding fumes and gases cannot be classified simply. The composition and quantity of these fumes and gases are dependent upon the metal being welded, the procedures being followed and the electrodes used. Workers should be aware that the composition and quantity of fumes and gases to which they may be exposed, are influence by: coatings which may be present on the metal being welded (such as paint, plating, or galvanizing), the number of welders in the operation and the volume of the work area, the quality and amount of ventilation, the position of the welder's head with respect to the fume plume, as well as the presence of contaminants in the atmosphere (such as chlorinated hydrocarbon vapors from cleaning and degreasing procedure). When the electrode is consumed, the fumes and gas decomposition products generated are different in percent and form from the ingredients listed in **Section 3**. The composition of these fumes and gases are the concerning matter and not the composition of the electrode itself. Decomposition products include those originating from the volatilization, reaction, or oxidation of the ingredients shown in **Section 3**, plus those from the base metal, coating and other factors noted above.

11.2 Symptoms

See **Section 4.2** for symptoms related to the physical, chemical, and toxicological characteristics.

11.3 Short and Long Term Effects

Inhalation (Acute):	Overexposure to welding fumes may result in discomfort such as dizziness, nausea, or dryness or irritation of nose, throat, or eyes. Inhalation of extremely high levels of fluorides may cause abdominal pain, diarrhea, muscular weakness and convulsions.
Inhalation (Chronic):	Continued inhalation could cause loss of consciousness and death.
Skin Contact (Acute):	Arc rays can burn skin.
Skin Contact (Chronic):	No data available.
Eye Contact (Acute):	Arc rays can injure eyes.
Eye Contact (Chronic):	No data available.
Ingestion (Acute):	No data available.
Ingestion (Chronic):	No data available.

11.4 Numerical Measures of Toxicity

In a studied case of chronic lung disease in a worker exposed to several metals, titanium was found in lung biopsy. Lack of toxicity by contact with skin and tissues has been demonstrated by its use in therapy of skin disorders and in surgical appliances. Food is considered to be the principal source of titanium exposure for humans. The only carcinogenic effects of titanium thus far reported have been the development of fibrosarcomas at the injection sites in exposed rats. There is no evidence that titanium is carcinogenic in humans. It was concluded that the current extent of exposure to titanium of the general population does not pose a health risk.

11.5 Carcinogen Status

OSHA (29 CRF 1910.1200) lists Nickel and Chromium as a possible carcinogen.

Section 12: Ecological Information

12.1 Ecotoxicity
No data available.

12.2 Persistence and Degradability
No data available.

12.3 Bioaccumulative Potential
No data available.

12.4 Mobility in Soil
No data available.

12.5 Other Adverse Effects
Report of lung changes in animals exposed for 5 months to titanium combined with carbon. Changes were said to resemble silicosis, lesions not found in animals exposed for several years to dust of carboloy which contains titanium carbon compound.

Section 13: Disposal Considerations

Discard any product, residue, disposal container, or liner in an environmentally acceptable manner approved by Federal, State, and Local regulations.

Section 14: Transport Information

14.1 UN Number
Not applicable.

14.2 UN Proper Shipping Name
Not applicable.

14.3 Transport Hazard Class(es)

U.S. Department of Transportation:	No classification assigned.
CA Transportation/Dangerous Goods:	No classification assigned.
Land Transport ADR:	No classification assigned.
Land Transport RID:	No classification assigned.
Air Transport IATA:	No classification assigned.
Air Transport ICAO:	No classification assigned.
Maritime Transport IMDG:	No classification assigned.

14.4 Packing Group
No classification assigned.

14.5 Environmental Hazards
No data available.

14.6 Transport in Bulk
No data available.

14.7 Special Precautions
No data available.

Section 15: Regulatory Information

US Regulations
CERCLA 102A/103 (40 CFR 302.4): Not regulated.

SARA Title III
Section 302 (40 CFR 355.30): Not regulated.
Section 304 (40 CFR 355.40): Not regulated.
Sections 311/312 (40 CFR 370.21): Not regulated.
Section 313 (40 CFR 372.65): Not regulated.

OSHA Process Safety: Not regulated.

State Regulations
California Proposition 65: Not regulated.

National Inventory Status
US Inventory (TSCA): Listed on inventory.
TSCA 12(b) Export Notification: Not listed.

Section 16: Other Information

The information in this Safety Data Sheet meets the requirements of the United States Department of Labor OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION and regulations promulgated thereunder (29 CFR 1910.1200 et. seq.). This document is intended only as a guide to the appropriate precautionary material handling by a person trained in, or supervised by a person trained in, chemical handling. Exposure to this chemical may have serious adverse health effects. This chemical may interact with other substances. Since the potential uses are so varied, all of the potential hazards of use or interaction with other chemicals or materials cannot be identified on this Safety Data Sheet. The user should recognize that this chemical can cause injury, especially if improperly handled, precautionary measures are not followed, and personal protective equipment not worn. Read and understand all precautionary information prior to use. The Defense Logistics Agency (DLA) shall not be held liable for any damage resulting from handling or from contact with the above chemical.

References:

WA. Alloy Co. *Material Safety Data Sheet Product Name: Titanium Alloy*. March 2005. (as provided by the Defense Logistics Agency)

American Conference of Governmental Industrial Hygienists. *2013 TLVs® and BEIs®*, ACGIH® Publication #0113. 2013.

National Institute of Health, Toxicology Data Network. http://toxnet.nlm.nih.gov/

Centers for Disease Control and Prevention. *NIOSH Pocket Guide to Chemical Hazards*, http://www.cdc.gov/niosh/npg/.

US Department of Transportation. *Emergency Response Guidebook*. 2012

NOTE: No data available: no data for this topic found using references listed.

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