

SAFETY DATA SHEET

1. Identification

Product identifier	TITANIUM ALLOYS WITH VANADIUM
Other means of identification	
SDS number	341
Version #	06
Revision date	October 27, 2015.
Other means of identification	
Synonyms	3-2.5; 3Al-2.5V, 6-4, 6-6-2, 6Al-4V, 6Al-6V-2Sn, 8-1-1, 8Al-1Mo-1V, 10-2-3, 10V-2Fe-3Al, 13-11-3, 13V-11Cr-3Al, 15-3-3-3, 15V-3Al-3Cr-3Sn, 64, 64ELI, 662, Ti-5553, Ti-3Al-2.5V, Ti-6-2-4-2, Ti-6Al-4V * Ti-6Al-4V(ELI), Ti-6Al-6V-2Sn, Ti-10V-2Fe-3Al, Ti-8Al-1V-1Mo, Ti-13V-11Cr-3Al, Ti-15V-3Al-3Cr-3Sn, Ti-3Al-8V-6Cr-4Mo-4Zr, TiBetaC
Recommended use	Titanium forgings and aerospace castings
Recommended restrictions	For industrial use only.
Manufacturer/Importer/Supplier/Distributor information	
Manufacturer	Stanford Advanced Materials Address : 23661 Birtcher Dr., Lake Forest, CA 92630 U.S.A. Tel: (949) 407-8904 Fax: (949) 812-6690

Emergency Information (949) 407-8904
(This telephone number is available 24 hours per day, 7 days per week.)

Website www.samaterials.com

2. Hazard(s) identification

Classification

This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).

Potential health effects

The following statements summarize the health effects generally expected in cases of overexposures. User specific situations should be assessed by a qualified individual. Additional health information can be found in Section 11.

The health effects listed below are not likely to occur unless processing of this product generates dusts or fumes.

Physical hazards	Not classified.
Health hazards	Not classified.
Environmental hazards	Not classified.
Authority defined hazards	Combustible dust

Label elements

Hazard symbol	None.
Signal word	Warning
Hazard statement	The mixture does not meet the criteria for classification. May form combustible dust concentrations in air.

Precautionary statement	
Prevention	Prevent dust accumulation to minimize explosion hazard.
Response	In case of fire: Use appropriate media to extinguish.
Storage	Store away from incompatible materials. Store in a dry place.
Disposal	Dispose of contents/container in accordance with local/regional/national/international regulations.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	None.
Specific hazards	<p>Non-combustible as supplied. Small chips, fine turnings, and dust from processing may be readily ignitable.</p> <p>Explosion/fire hazards may be present when (See Sections 5, 7 and 10 for additional information):</p> <ul style="list-style-type: none"> • Dust or fines are dispersed in air. • Dust and fines are in contact with certain metal oxides (e.g., rust, copper oxide). <p>A thermite reaction, with considerable heat generation, can be initiated by a weak ignition source. Thermite reactions can also occur with oxides of lead, copper, iron, bismuth and certain other metals.</p> <ul style="list-style-type: none"> • Dust and fines in contact with water can generate flammable/explosive hydrogen gas. These gases could present an explosion hazard in confined or poorly ventilated spaces. • Contact of molten metal with water or moisture can result in a rapid generation of steam which may produce a violent splattering of molten metal. <p>Health effects from mechanical processing (e.g., cutting, grinding): Dust: Can cause irritation of the eyes, skin and upper respiratory tract. Acute overexposures: Can cause headache and sore joints.</p> <p>Additional health effects from elevated temperature processing (e.g., welding, melting): Dust and fumes: Can cause irritation irritation of the eyes, skin and respiratory tract. Can cause inflammation of the eyes and eyelids (conjunctivitis). Acute overexposures: Can cause metal fume fever and the accumulation of fluid in the lungs. The substance has delayed effects.</p>

3. Composition/information on ingredients

Composition comments Complete composition is provided below and may include some components classified as non-hazardous.

Mixtures

Chemical name	Common name and synonyms	CAS number	%
Titanium		7440-32-6	55 - 95
Vanadium		7440-62-2	1 - 15
Chromium		7440-47-3	0 - 11
Aluminum		7429-90-5	3 - 8
Molybdenum		7439-98-7	0 - 5
Zirconium		7440-67-7	0 - 5
Tin		7440-31-5	0 - 3
Iron		7439-89-6	0 - 2
Copper		7440-50-8	0 - 2

Additional Information Additional compounds which may be formed during processing are listed in Section 8.

4. First-aid measures

Eye contact	Dust and fumes from processing: Rinse eyes with plenty of water or saline for at least 15 minutes. Consult a physician.
Skin contact	Dust and fumes from processing or contact with lubricant/residual oil: Wash with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.
Inhalation	Dust and fumes from processing: Remove to fresh air. Check for clear airway, breathing, and presence of pulse. If breathing is difficult, provide oxygen. Loosen any tight clothing on neck or chest. Provide cardiopulmonary resuscitation for persons without pulse or respirations. Consult a physician.
Ingestion	Not relevant, due to the form of the product.

Most important symptoms/effects, acute and delayed	Health effects from mechanical processing (e.g., cutting, grinding): Dust: Can cause irritation of the eyes, skin and upper respiratory tract. Acute overexposures: Can cause headache and sore joints.
Medical conditions aggravated by exposure	Additional health effects from elevated temperature processing (e.g., welding, melting): Dust and fumes: Can cause irritation of the eyes, skin and respiratory tract. Acute overexposures: Can cause the accumulation of fluid in the lungs. Effects can be delayed up to 24 hours. See Section 11 of the SDS for additional information on health hazards.
Indication of immediate medical attention and special treatment needed	Dust and fume from processing: Asthma, chronic lung disease, and skin rashes.
General information	Provide general supportive measures and treat symptomatically.
General information	Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

5. Fire-fighting measures

Suitable extinguishing media	Use Class D extinguishing agents on fines, dust or molten metal. Use gentle surface application of Class D extinguishing agent or dry inert granular material (e.g., sand) to cover and ring the burning material.
Unsuitable extinguishing media	DO NOT USE water spray, carbon dioxide, foam or standard dry chemical extinguishers unless the fire involves only the oily residues from the machining process. These fire extinguishing agents will react with the burning material.
Specific hazards arising from the chemical	May be a potential hazard under the following conditions: <ul style="list-style-type: none"> • Dust clouds may be explosive. Even a minor dust cloud can explode violently. Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions. • Dust and fines in contact with certain metal oxides (e.g., rust, copper oxide). A thermite reaction, with considerable heat generation, can be initiated by a weak ignition source. Finely divided metals (e.g., powders or wire) may have enough surface oxide to produce thermite reactions/explosions. Thermite reactions can also occur with oxides of lead, copper, iron, bismuth and certain other metals.
Special protective equipment and precautions for firefighters	Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.
Fire fighting equipment/instructions	Move containers from fire area if you can do so without risk. Apply extinguishing media carefully to avoid creating airborne dust. If impossible to extinguish, protect surroundings and allow fire to burn itself out.
General fire hazards	Castings and ingots are not combustible under ordinary conditions. Small chips, fine turnings, and dust from processing may be readily ignitable. Grinding or polishing this material in the absence of oxygen, such as under water, can result in a finely divided material that is ignitable. Dry titanium fines collected in cyclones have ignited spontaneously when allowed to fall freely through air. Sump fines can spontaneously ignite when dried.

Explosion data

Sensitivity to mechanical impact	Not sensitive.
Sensitivity to static discharge	Take precautionary measures against static discharges when there is a risk of dust explosion.

6. Accidental release measures

Personal precautions, protective equipment and emergency procedures	Use personal protection recommended in Section 8 of the SDS.
Personal precautions, protective equipment and emergency procedures	
For emergency responders	Use personal protection recommended in Section 8 of the SDS.
Evacuation procedures	None necessary.
Methods and materials for containment and cleaning up	Collect scrap for recycling.

7. Handling and storage

Handling	Avoid contact with sharp edges or heated metal. Avoid generating dust. Use personal protection recommended in Section 8 of the SDS.
Storage	Store away from incompatible materials (see Section 10 of the SDS). Store in accordance with local/regional/national/international regulation.

Requirements for Processes Which Generate Dusts or Fines

Use water based coolants during machining, grinding, sanding or drilling. Operations producing dust should be equipped with a dust collection system discharging into a water-type dust collector. Maintain humidity above 50% to prevent an electrostatic build up. Use non-sparking handling equipment per NFPA 484 and 654. Prohibit smoking. Store wet and keep away from heat and open flame.

Good housekeeping practices must be maintained. Do not use compressed air to remove settled material from floors, beams or equipment.

8. Exposure controls/personal protection

Exposure guidelines

The following constituents are the only constituents of the product which have a PEL, TLV or other recommended exposure limit. At this time, the other constituents have no known exposure limits.

Occupational exposure limits

U.S. - OSHA Components

Components	Type	Value	Form
Aluminum (CAS 7429-90-5)	TWA	5 mg/m3 15 mg/m3	Respirable fraction Total dust
Chromium (CAS 7440-47-3)	TWA	1 mg/m3	
Copper (CAS 7440-50-8)	TWA	1 mg/m3	Dust and mist.
Molybdenum (CAS 7439-98-7)	TWA	0.1 mg/m3 15 mg/m3	Fume. Total dust.

Compounds Formed During Processing

Compounds Formed During Processing	Type	Value	Form
Aluminum oxide (non-fibrous) (CAS 1344-28-1)	TWA	5 mg/m3 15 mg/m3	Respirable fraction. Total dust.
Chromium (II) compounds	TWA	0.5 mg/m3	(as Cr)
Chromium (III) compounds	TWA	0.5 mg/m3	(as Cr)
Chromium (VI) compounds, certain water insoluble forms	TWA	0.0025 mg/m3	Action Level as Cr(VI))
Chromium (VI) compounds	TWA	0.0025 mg/m3	Action Level as Cr(VI)
Iron oxide (CAS 1309-37-1)	TWA	10 mg/m3	Fume.
Molybdenum insoluble compounds	TWA	15 mg/m3	Total dust.
Vanadium pentoxide (CAS 1314-62-1)	Ceiling	0.5 mg/m3	(respirable dust)

Residuals

Residuals	Type	Value	Form
Oil mist, mineral (CAS 8012-95-1)	TWA	5 mg/m3	Mist.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Compounds Formed During Processing	Type	Value	Form
Chromium (VI) compounds, certain water insoluble forms	TWA	0.005 mg/m3	as Cr(VI)
Chromium (VI) compounds, water soluble forms	TWA	0.005 mg/m3	
Chromium (VI) compounds	TWA	0.005 mg/m3	as Cr(VI)

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value	Form
Tin (CAS 7440-31-5)	PEL	2 mg/m3	
Compounds Formed During Processing	Type	Value	Form
Titanium dioxide (CAS 13463-67-7)	TWA	15 mg/m3	Total dust.
Vanadium pentoxide (CAS 1314-62-1)	Ceiling	0.5 mg/m3	Respirable dust.

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Compounds Formed During Processing	Type	Value	Form
Residuals	Type	Value	Form
Oil mist, mineral (CAS 8012-95-1)	PEL	5 mg/m3	Mist.
ACGIH Components	Type	Value	Form
Copper (CAS 7440-50-8)	TWA	1 mg/m3	(Dust and Mist)
		0.2 mg/m3	Fume
Compounds Formed During Processing	Type	Value	Form
Aluminum oxide (non-fibrous) (CAS 1344-28-1)	TWA	1 mg/m3	Respirable fraction, as Al
Chromium (VI) compounds, water soluble forms	TWA	0.05 mg/m3	(as Cr)
Chromium (VI) compounds	TWA	0.05 mg/m3	Soluble compounds as Cr
Titanium dioxide (CAS 13463-67-7)	TWA	10 mg/m3	Total dust
Vanadium pentoxide (CAS 1314-62-1)	TWA	0.05 mg/m3	(inhalable fraction)
US ACGIH Threshold Limit Values: Short Term Exposure Limit (STEL): mg/m3			
Components	Type	Value	
Zirconium (CAS 7440-67-7)	STEL	10 mg/m3	
Compounds Formed During Processing	Type	Value	
Zirconium compounds	STEL	10 mg/m3	
US ACGIH Threshold Limit Values: Time Weighted Average (TWA): mg/m3, non-standard units			
Components	Type	Value	Form
Aluminum (CAS 7429-90-5)	TWA	1 mg/m3	Respirable fraction.
Chromium (CAS 7440-47-3)	TWA	0.5 mg/m3	
Tin (CAS 7440-31-5)	TWA	2 mg/m3	
Zirconium (CAS 7440-67-7)	TWA	5 mg/m3	
Compounds Formed During Processing	Type	Value	Form
Chromium (III) compounds	TWA	0.5 mg/m3	
Chromium (VI) compounds, certain water insoluble forms	TWA	0.01 mg/m3	(as Cr)
Chromium (VI) compounds	TWA	0.01 mg/m3	Insoluble compounds as Cr
Iron oxide (CAS 1309-37-1)	TWA	5 mg/m3	Respirable fraction.
Molybdenum insoluble compounds	TWA	3 mg/m3	Respirable fraction.
		10 mg/m3	Inhalable fraction.
Vanadium pentoxide (CAS 1314-62-1)	TWA	0.05 mg/m3	Inhalable fraction.
Zirconium compounds	TWA	5 mg/m3	
Residuals	Type	Value	Form
Oil mist, mineral (CAS 8012-95-1)	TWA	5 mg/m3	Inhalable fraction.
Alcoa Components	Type	Value	Form
Aluminum (CAS 7429-90-5)	TWA	3 mg/m3	Respirable fraction

Alcoa Components	Type	Value	Form
Compounds Formed During Processing	Type	10 mg/m3 Value	Total dust Form
Aluminum oxide (non-fibrous) (CAS 1344-28-1)	TWA	3 mg/m3	Respirable fraction.
Chromium (VI) compounds	TWA	10 mg/m3 0.25 µg/m3	Total dust.
Residuals	Type	Value	Form
Oil mist, mineral (CAS 8012-95-1)	TWA	0.5 mg/m3	(8 Hour)

General	<p>Personnel who handle and work with molten metal should utilize primary protective clothing like polycarbonate face shields, fire resistant tapper's jackets, neck shades (snoods), leggings, spats and similar equipment to prevent burn injuries. In addition to primary protection, secondary or day-to-day work clothing that is fire resistant and sheds metal splash is recommended for use with molten metal. Synthetic materials should never be worn even as secondary clothing (undergarments).</p> <p>If the product is coated with oil, wear oil-resistant gloves to avoid skin contact. Minimize breathing oil vapors and mist. Remove oil contaminated clothing; launder or dry-clean before reuse. Remove oil contaminated shoes and thoroughly clean and dry before reuse. Cleanse skin thoroughly after contact, before breaks and meals, and at the end of the work period. Oil coating is readily removed from skin with waterless hand cleaners followed by a thorough washing with soap and water.</p>
Appropriate engineering controls	Dust and fumes from processing: Use with adequate explosion-proof ventilation designed to handle particulates to meet the limits listed in Section 8, Exposure Guidelines.
Individual protection measures, such as personal protective equipment	
Eye/face protection	Wear safety glasses with side shields (or goggles). Molten metal: Tinted safety glasses or face shield. Wear a face shield when working with molten material.
Skin protection	
Hand protection	Wear appropriate gloves to avoid any skin injury. The need for personal protective equipment (gloves) should be based upon a hazard assessment and recommendations from health / safety professionals. The most suitable glove must be chosen in consultation with the gloves supplier, who can inform about the breakthrough time of the glove material.
Other	The need for personal protective equipment should be based upon a hazard assessment and recommendations from health / safety professionals.
Respiratory protection	Dust and fumes from processing: Use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the limits listed in Section 8. Suggested respiratory protection: P95.
Thermal hazards	Wear appropriate thermal protective clothing, when necessary.
General hygiene considerations	Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and immediately after handling the product. When using, do not eat, drink or smoke.
Control parameters	Follow standard monitoring procedures.
Environmental exposure controls	No special environmental precautions required.

9. Physical and chemical properties

Form	Solid, various shapes and sizes.
Color	Gray.
Odor	Odorless
Odor threshold	Not applicable
pH	Not applicable
Density	4.56 g/cm3 Titanium
Melting point/freezing point	2800.4 - 3200 °F (1538 - 1760 °C)
Initial boiling point and boiling range	Not determined
Flash point	Not applicable

Evaporation rate	Not applicable.
Flammability (solid, gas)	Not applicable.
Upper/lower flammability or explosive limits	
Flammability limit - upper (%)	Not applicable
Flammability limit - lower (%)	Not applicable
Explosive properties	Dust clouds may be explosive under certain conditions.
Dust explosion properties	
St class	Strong explosion.
Vapor pressure	Not applicable
Vapor density	Not applicable
Relative density	Not determined
Solubility(ies)	Insoluble
Specific gravity	Not determined
Partition coefficient (n-octanol/water)	Not applicable
Auto-ignition temperature	Not applicable
Decomposition temperature	Not applicable
Viscosity	Not applicable

10. Stability and reactivity

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.
Chemical stability	Stable under normal conditions of use, storage, and transportation.
Possibility of hazardous reactions	Hazardous polymerization does not occur.
Conditions to avoid	Dry titanium fines collected in cyclones have ignited spontaneously when allowed to fall freely through air. Sump fines can spontaneously ignite when dried.
Incompatible materials	At abnormally high temperatures, descaling baths of mineral acids and molten alkali salts may cause violent reactions. Titanium surfaces that have been treated with nitric acid, particularly with red fuming nitric acid containing 10-20% nitrogen tetroxide, become pyrophoric and may be explosive. Large titanium shapes will ignite spontaneously on contact with liquid oxygen. Thermite reactions can occur with oxides of lead, copper, iron, bismuth and certain other metals.
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Health effects associated with ingredients

Titanium: Generally considered to be biologically inert.

Chromium dust and fumes: Can cause irritation of eye, skin and respiratory tract. Metallic chromium and trivalent chromium: Not classifiable as to their carcinogenicity to humans by IARC.

Aluminum dust/fines and fumes: Low health risk by inhalation. Generally considered to be biologically inert (milling, cutting, grinding).

Molybdenum dust and fumes: Can cause irritation of mucous membranes, skin and respiratory tract. Acute overexposures: Can cause headache, backache and sore joints. Chronic overexposures: Can cause deformities of the joints, blood disorders, kidney damage, lung damage and liver damage.

Tin (dust or fume): Chronic overexposures: Can cause benign lung disease (stannosis).

Copper dust/mists: Can cause irritation of the eyes, mucous membranes, skin, and respiratory tract. Chronic overexposures: Can cause reduction in the number of red blood cells (anemia), skin abnormalities (pigmentation changes) and hair discoloration.

Some products are supplied with an oil coating or have residual oil from the manufacturing process. Oil: Can cause irritation of skin. Skin contact (prolonged or repeated): Can cause dermatitis.

Health effects associated with compounds formed during processing

The following could be expected if welded, remelted or otherwise processed at elevated temperatures:

Titanium dioxide: Can cause irritation of eyes and respiratory tract. Chronic overexposures: Can cause chronic bronchitis. IARC/NTP: Listed as possibly carcinogenic to humans by IARC (Group 2B).

Vanadium pentoxide: Can cause irritation of eyes, skin and respiratory tract. Skin contact (prolonged or repeated): Can cause sensitization and dermatitis. Acute overexposures: Can cause inflammation of the eyes and eyelids (conjunctivitis), bronchitis and fluid in the lungs (pulmonary edema). Effects can be delayed up to 3 days. Chronic overexposures: Can cause kidney damage, blindness, asthma and emphysema. IARC/NTP: Listed as possibly carcinogenic to humans by IARC (Group 2B).

Hexavalent chromium compounds (Chromium VI): Can cause irritation of eye, skin and respiratory tract. Skin contact: Can cause irritant dermatitis, allergic reactions and skin ulcers. Chronic overexposures: Can cause perforation of the nasal septum, respiratory sensitization, asthma, the accumulation of fluid in the lungs (pulmonary edema), lung damage, kidney damage, lung cancer, nasal cancer and cancer of the gastrointestinal tract. IARC/NTP: Listed as "known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1).

Alumina (aluminum oxide): Low health risk by inhalation. Generally considered to be biologically inert.

Molybdenum trioxide: Can cause irritation of eyes, mucous membranes and upper respiratory tract. Chronic overexposures: Can cause reduction in the number of red blood cells (anemia), predisposition to gout, thyroid function changes, liver damage and lung damage. Additional information: Studies with experimental animals by inhalation have found lung cancer.

Zirconium compounds: Skin contact (prolonged or repeated): Can cause lumps on the skin (granulomas).

Tin compounds, inorganic (dust or fume): Can cause irritation of eyes, skin and respiratory tract.

Iron oxide: Chronic overexposures: Can cause benign lung disease (siderosis). Ingestion: Can cause irritation of gastrointestinal tract, bleeding, changes in the pH of the body fluids (metabolic acidosis) and liver damage.

Copper fume: Can cause irritation of the eyes, mucous membranes, and respiratory tract. Acute overexposures: Can cause metal fume fever (nausea, fever, chills, shortness of breath and malaise).

If the product is heated well above ambient temperatures or machined, oil vapor or mist may be generated.

Oil vapor or mist: Can cause irritation of respiratory tract. Acute overexposures: Can cause bronchitis, headache, central nervous system effects (nausea, dizziness and loss of coordination) and drowsiness (narcosis).

Information on likely routes of exposure

Eye contact

Dust and fumes from processing: Can cause irritation.

Additional health effects from elevated temperature processing (e.g., welding): Dust and fumes: Can cause inflammation of the eyes and eyelids (conjunctivitis).

Skin contact

Dust from processing: Can cause irritation. Prolonged or repeated skin contact may cause lumps on the skin (granulomas).

Additional health effects from elevated temperature processing (e.g., welding): Prolonged or repeated skin contact may cause sensitization and allergic contact dermatitis.

Contact with residual oil/oil coating: Prolonged or repeated skin contact may cause dermatitis.

Inhalation

Dust: Can cause irritation of the upper respiratory tract. Acute exposure: Can cause headache and sore joints. Chronic overexposures: Can cause deformities of the joints, blood disorders and kidney damage.

Additional health effects from elevated temperature processing (e.g., welding): Dust and fumes: Can cause irritation of the respiratory tract. Acute exposure: Can cause the accumulation of fluid in the lungs (pulmonary edema). Effects can be delayed for several days. Chronic overexposures: Can cause chronic bronchitis, respiratory sensitization, nasal cancer and lung cancer.

Ingestion

Not relevant, due to the form of the product.

Symptoms related to the physical, chemical and toxicological characteristics

Health effects from mechanical processing (e.g., cutting, grinding): Dust: Can cause irritation of the eyes, skin and upper respiratory tract. Acute overexposures: Can cause headache and sore joints.

Additional health effects from elevated temperature processing (e.g., welding): Dust and fumes: Can cause irritation of the eyes, skin and respiratory tract. Can cause inflammation of the eyes and eyelids (conjunctivitis). Acute overexposures: Can cause the accumulation of fluid in the lungs. Effects can be delayed for several days.

Information on toxicological effects

Components	Species	Test Results
Aluminum (CAS 7429-90-5)		
Acute		
Inhalation		
LC50	Rat	> 2.3 mg/l 7.6 mg/l
Oral		
LD50	Rat	> 2000 mg/kg
Acute toxicity	Not classified. Based on available data, the classification criteria are not met.	
Skin corrosion/irritation	Non-corrosive.	
Serious eye damage/eye irritation	Based on available data, the classification criteria are not met.	
Respiratory or skin sensitization	Not classified. Based on available data, the classification criteria are not met.	
Respiratory sensitization	Not classified. Based on available data, the classification criteria are not met.	
Skin sensitization	Not classified. Based on available data, the classification criteria are not met.	
Germ cell mutagenicity	Based on available data, the classification criteria are not met.	
Neurological effects	Not classified. Based on available data, the classification criteria are not met.	
Pre-existing conditions aggravated by exposure	Dust from processing: Asthma, chronic lung disease, and skin rashes.	
Carcinogenicity	Not classified. Based on available data, the classification criteria are not met.	
ACGIH Carcinogens		
Aluminum (CAS 7429-90-5)	Not classifiable as a human carcinogen. A4	
Chromium (CAS 7440-47-3)	Not classifiable as a human carcinogen. A4	
Chromium (III) compounds (CAS Varies)	Not classifiable as a human carcinogen. A4	
Chromium (VI) compounds (CAS Varies)	A1 Confirmed human carcinogen.	
Molybdenum (CAS 7439-98-7)	A3 Confirmed animal carcinogen with unknown relevance to humans.	
Oil mist, mineral (CAS 8012-95-1)	A2 Suspected human carcinogen.	
Titanium dioxide (CAS 13463-67-7)	Not classifiable as a human carcinogen. A4	
Zirconium (CAS 7440-67-7)	Not classifiable as a human carcinogen. A4	
Zirconium compounds (CAS Varies)	Not classifiable as a human carcinogen. A4	
IARC Monographs. Overall Evaluation of Carcinogenicity		
Chromium (CAS 7440-47-3)	3 Not classifiable as to carcinogenicity to humans.	
Chromium (III) compounds (CAS Varies)	3 Not classifiable as to carcinogenicity to humans.	
Chromium (VI) compounds (CAS Varies)	1 Carcinogenic to humans.	
Titanium dioxide (CAS 13463-67-7)	2B Possibly carcinogenic to humans.	
US. National Toxicology Program (NTP) Report on Carcinogens		
Chromium (VI) compounds (CAS Varies)	Known To Be Human Carcinogen.	
Oil mist, mineral (CAS 8012-95-1)	Known To Be Human Carcinogen.	
US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)		
Chromium (VI) compounds (CAS Varies)	Cancer	
Reproductive toxicity	Not classified. Based on available data, the classification criteria are not met.	
Routes of exposure	Inhalation. Skin contact. Eye contact.	
Specific target organ toxicity - single exposure	Not classified. Based on available data, the classification criteria are not met.	
Specific target organ toxicity - repeated exposure	Not classified. Based on available data, the classification criteria are not met.	
Aspiration hazard	Not classified. Based on available data, the classification criteria are not met.	
12. Ecological information		
Ecotoxicity	Not expected to be harmful to aquatic organisms.	

Components	Species	Test Results
Chromium (CAS 7440-47-3)		
Aquatic		
Crustacea	EC50	Water flea (Daphnia magna) 0.01 - 0.7 mg/l, 48 hours
Fish	LC50	Carp (Cyprinus carpio) 14.3 mg/l, 96 hours
Copper (CAS 7440-50-8)		
Aquatic		
Crustacea	EC50	Water flea (Daphnia magna) 0.036 mg/l, 48 hours
Fish	LC50	Fathead minnow (Pimephales promelas) 0.0319 - 0.0544 mg/l, 96 hours
Iron (CAS 7439-89-6)		
Aquatic		
Crustacea	LC50	Cockle (Cerastoderma edule) 100 - 330 mg/l, 48 hours
		Common shrimp, sand shrimp (Crangon crangon) 33 - 100 mg/l, 48 hours
Fish	LC50	Channel catfish (Ictalurus punctatus) > 500 mg/l, 96 hours
Molybdenum (CAS 7439-98-7)		
Aquatic		
Fish	LC50	Rainbow trout, donaldson trout (Oncorhynchus mykiss) 800 mg/l, 96 hours

Persistence and degradability No data is available on the degradability of this product.
Bioaccumulative potential No data available on bioaccumulation.
Mobility in soil No data available.
Other adverse effects None known.

13. Disposal considerations

Disposal instructions Reuse or recycle material whenever possible. Keep scrap separate from other metal scrap. If reuse or recycling is not possible, disposal must be made according to local or governmental regulations.

Waste codes RCRA Status: Not federally regulated in the U.S. if disposed of "as is."
RCRA waste codes other than described here may apply depending on use of the product. Status must be determined at the point of waste generation. Refer to 40 CFR 261 or state equivalent in the U.S. TCLP testing is recommended for chromium in a waste disposal scenario.

Waste from residues / unused products If reuse or recycling is not possible, disposal must be made according to local or governmental regulations.

Contaminated packaging Dispose of in accordance with local regulations.

14. Transport information

General Shipping Information

Basic Shipping Information

ID number -
Proper shipping name Not regulated
Hazard class -
Packing group -

General Shipping Notes

• When "Not regulated", enter the proper freight classification, SDS Number and Product Name onto the shipping paperwork.

Disclaimer

This section provides basic classification information and, where relevant, information with respect to specific modal regulations, environmental hazards and special precautions. Otherwise, it is presumed that the information is not available/not relevant

15. Regulatory information

US federal regulations In reference to Title VI of the Clean Air Act of 1990, this material does not contain nor was it manufactured using ozone-depleting chemicals.
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200. Electrical equipment should meet National Fire Protection Association (NFPA) requirements for locations where material is processed.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Chromium (VI) compounds (CAS Varies) 0.1 % Annual Export Notification required.

CERCLA Hazardous Substance List (40 CFR 302.4)Chromium (CAS 7440-47-3) Listed.
Copper (CAS 7440-50-8) Listed.**US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)**Chromium (VI) compounds (CAS Varies) Cancer
Eye irritation
Skin sensitization**Superfund Amendments and Reauthorization Act of 1986 (SARA)**

Section 311/312 hazard categories	Immediate Hazard - Yes	If particulates/fumes generated during processing.
	Delayed Hazard - Yes	If particulates/fumes generated during processing.
	Fire Hazard - No	
	Pressure Hazard - No	
	Reactivity Hazard - No	

SARA 302 Extremely hazardous substance

Chemical name	CAS number	Reportable quantity	Threshold planning quantity	Threshold planning quantity, lower value	Threshold planning quantity, upper value
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None

SARA 311/312 Hazardous chemical Yes

Disclaimer

The user of this SDS should verify the substance specific concentration information as it relates to regulatory reporting. Listed concentrations may cover a range of formulations and process batch variations.

Superfund Amendments and Reauthorization Act of 1986 (SARA)**SARA 313 (TRI reporting)**

Chemical name	CAS number	% by wt.
Vanadium	7440-62-2	1 - 15
Chromium	7440-47-3	0 - 11
Aluminum	7429-90-5	3 - 8
Copper	7440-50-8	0 - 2

US state regulations**US. California Proposition 65**

California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65): This material is not known to contain any chemicals currently listed as carcinogens or reproductive toxins.

International Inventories

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

A "No" indicates that one or more components of the product are not listed or exempt from listing on the inventory administered by the governing country(s).

16. Other information, including date of preparation or last revision

SDS Status

October 27, 2015: Change(s) in Section: 15 and 16.
October 2, 2015: Change(s) in Section: 15 and 16.
May 28, 2015: New format.
February ??, 2015: Change(s) in Section: 1, 2, 4, 10, 11 and 15.
October 12, 2007: Reviewed on a periodic basis in accordance with Alcoa policy. Change(s) in Section: 1, 2, 3, 4, 5, 7, 8, 10, 11, 12, 13, 14 and 15.
June 23, 2004: Change(s) in Section: 1, 2, 3, 5, 8 and 12.
August 20, 2001: Change(s) in Section: 1, 2, 3, 7 and 8. Includes products formerly covered on Howmet SDSs 401 and 402.
Origination date: January 26, 1984

Hazardous Materials Control Committee
Preparer: Jim Perriello

SDS System Number: 115958
December 6, 2010: New format.

Revision date

October 27, 2015.

Version

06

Revision Information

Identification: Recommended Restrictions
Hazard(s) identification: Storage
Hazard(s) identification: GHS Symbols
Composition / Information on Ingredients: Disclosure Overrides
Fire-fighting measures: Suitable extinguishing media
Exposure controls/personal protection: Eye/face protection
Physical & Chemical Properties: Multiple Properties
Physical and chemical properties: Form
Stability and reactivity: Possibility of hazardous reactions
Regulatory information: Disclaimer
Regulatory information: US federal regulations
Other information, including date of preparation or last revision: Other information 2
GHS: Classification

Disclaimer

The information in the sheet was written based on the best knowledge and experience currently available.

Other information

- Guide to Occupational Exposure Values 2015, Compiled by the American Conference of Governmental Industrial Hygienists (ACGIH).
- NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, September 2005.
- expub, Expert Publishing, LLC., www.expub.com,
- Ariel, 3E Company, www.3Ecompany.com

Key/Legend:

ACGIH	American Conference of Governmental Industrial Hygienists
AICS	Australian Inventory of Chemical Substances
CAS	Chemical Abstract Services
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPR	Cardio-pulmonary Resuscitation
DOT	Department of Transportation
DSL	Domestic Substances List (Canada)
EC	Effective Concentration
ED	Effective Dose
EINECS	European Inventory of Existing Commercial Chemical Substances
ENCS	Japan - Existing and New Chemical Substances
EWC	European Waste Catalogue
EPA	Environmental Protective Agency
IARC	International Agency for Research on Cancer
LC	Lethal Concentration
LD	Lethal Dose
MAK	Maximum Workplace Concentration (Germany) "maximale Arbeitsplatz-Konzentration"
NDSL	Non-Domestic Substances List (Canada)
NIOSH	National Institute for Occupational Safety and Health
NTP	National Toxicology Program
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
PIN	Product Identification Number
PMCC	Pensky Marten Closed Cup
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
SIMDUT	Système d'Information sur les Matières Dangereuses Utilisées au Travail
STEL	Short Term Exposure Limit
TCLP	Toxic Chemicals Leachate Program
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average
WHMIS	Workplace Hazardous Materials Information System

m meter, cm centimeter, mm millimeter, in inch,
g gram, kg kilogram, lb pound, µg microgram,
ppm parts per million, ft feet
*** End of SDS ***