

## SAFETY DATA SHEET

## Titanium Ti6Al4V

## SECTION 1: Identification

## 1.1. Product identifier

## Trade name

Titanium Ti6Al4V

## Other names / Synonyms

Document No. : H-5800-3498-02-B\_EN

## Product no.

A-5771-0406

## 1.2. Relevant identified uses of the substance or mixture and uses advised against

## Relevant identified uses of the substance or mixture

Metal powder for additive layer manufacture

## Uses advised against

None known.

## 1.3. Details of the supplier of the safety data sheet

## Company and address

**Renishaw plc**

New Mills

Wotton-under-Edge,

GL12 8JR, Gloucestershire,

United Kingdom

+44 (0) 1453 524524

www.renishaw.com

## E-mail

msds@renishaw.com

## SDS date

2/9/2023

## SDS Version

1.0

## 1.4. Emergency telephone number

Contact the poison control at 1-800-222-1222 (24/7) or use the webPOISONCONTROL® (triage.webpoisoncontrol.org) to get specific guidance for your case

See also section 4 "First aid measures".

Emergency contact from supplier: +44 (0) 1453 524524 (UK office hours 08:00 to 17:00 UTC Monday to Thursday, 08:00 to 16:00 Friday)

## SECTION 2: Hazard(s) identification

## OSHA/HCS status

This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

## Classification of the substance or mixture

Flam. Sol. 1; H228, Flammable solid.

## 2.2. Label elements

## Hazard pictogram(s)



## Signal word

Danger

## Hazard statement(s)

Flammable solid. (H228)

## Safety statement(s)

Conforms to OSHA Hazard Communication Standard (HCS) (29 CFR 1910.1200 / revised 2012)

**General**

-

**Prevention**

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. (P210)

**Response**

In case of fire: Use water mist/carbon dioxide/alcohol-resistant foam to extinguish. (P370+P378)

**Storage**

-

**Disposal**

-

**Additional labelling**

Not applicable.

**2.3. Other hazards**

**Additional warnings**

Dust from flammable solids can be explosive, even if they are not hazardous substances.

This mixture/product does not contain any substances considered to meet the criteria classifying them as PBT and/or vPvB.

**SECTION 3: Composition/Information on Ingredients**

**3.1. Substances**

Not applicable. This product is a mixture.

**3.2. Mixtures**

<b>Product/substance</b>	<b>Identifiers</b>	<b>% w/w</b>	<b>Classification</b>	<b>Note</b>
Titanium	CAS No.: 7440-32-6	80-90%		
Aluminium	CAS No.: 7429-90-5	6-6.5%	Flam. Sol. 1, H228 Water-react. 2, H261	
Vanadium	CAS No.: 7440-62-2	3.8-4.5%		

Where the concentration of an ingredient is expressed as a range the exact concentration has been withheld as a trade secret.

See full text of H-phrases in section 16. Occupational exposure limits are listed in section 8, if these are available.

**Other information**

None known.

**SECTION 4: First-aid measures**

**4.1. Description of first aid measures**

**General information**

If breathing is irregular, drowsiness, loss of consciousness or cramps: Call 911 and give immediate treatment (first aid).

Contact a doctor if in doubt about the injured person's condition or if the symptoms persist. Never give an unconscious person water or other drink.

**Inhalation**

Upon breathing difficulties or irritation of the respiratory tract: Bring the person into fresh air and stay with him/her.

**Skin contact**

Remove contaminated clothing and shoes immediately. Ensure to wash exposed skin thoroughly with water and soap. Skin cleanser can be used. DO NOT use solvents or thinners.

**Eye contact**

Upon irritation of the eye: Remove contact lenses and open eyes widely. Flush eyes with water or saline water (20-30 °C) for at least 5 minutes. Seek medical assistance and continue flushing during transport.

**Ingestion**

If the person is conscious, rinse the mouth with water and stay with the person. Never give the person anything to drink.

In case of malaise, seek medical advice immediately and bring the safety data sheet or label from the product. Do not induce vomiting, unless recommended by the doctor. Have the person lean forward with head down to avoid

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inhalation of or choking on vomited material.

#### Burns

Rinse with water until pain stops then continue to rinse for 30 minutes.

#### 4.2. Most important symptoms and effects, both acute and delayed

None known.

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

None known.

#### Information to medics

Bring this safety data sheet or the label from this product.

### SECTION 5: Fire-fighting measures

#### 5.1. Extinguishing media

Suitable extinguishing media: Dry powder (Class D), sodium chloride (granulate) or dry sand.

Unsuitable extinguishing media: DO NOT USE WATER!

#### 5.2. Special hazards arising from the substance or mixture

Fire will result in dense smoke. Exposure to combustion products may harm your health. Closed containers, which are exposed to fire, should be cooled with water. Do not allow fire-extinguishing water to enter the sewage system and nearby surface waters.

#### 5.3. Advice for firefighters

Wear self-contained breathing apparatus and protective clothing to prevent contact. Upon direct exposure contact the Poison Help Line on 1-800-222-1222 (24/7) in order to obtain further advice.

### SECTION 6: Accidental release measures

#### 6.1. Personal precautions, protective equipment and emergency procedures

Storages not yet ignited must be cooled by water mist. Remove flammable materials if conditions allow it. Ensure sufficient ventilation.

Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration.

Evacuate surrounding areas.

Eliminate all ignition sources.

Ventilate the area.

Wear appropriate personal protective equipment (see section 8).

#### 6.2. Environmental precautions

Avoid discharge to lakes, streams, sewers, etc.

#### 6.3. Methods and material for containment and cleaning up

Cleaning up the material must be done only with squeegees or soft natural bristle brushes. Scoops used to pick up the material must be conductive and non-sparking. Synthetic bristle brushes and plastic or other non-conductive scoops must not be used, since they tend to accumulate strong static charges.

Collect spills carefully. Moist the material with water in order to prevent the formation and propagation of dust.

Wherever possible cleaning should be performed with normal cleaning agents. Avoid use of solvents.

Use spark-proof tools and explosion-proof equipment.

Avoid dust generation.

Ensure that waste and contaminated materials are collected and removed from the work area as soon as possible in a suitably labelled container.

#### 6.4. Reference to other sections

See section 13 "Disposal considerations" on handling of waste.

See section 8 "Exposure controls/personal protection" for protective measures.

### SECTION 7: Handling and storage

#### 7.1. Precautions for safe handling

Keep all containers sealed except when opened for removal of material. Reseal containers immediately after each use to prevent contamination or, in the case of pastes, loss of solvent.

Take precautionary measures against static discharges.

Smoking, drinking and consumption of food is not allowed in the work area.

Because of the danger of self-ignition, any waste from the product, spray mist and soiled rags etc. are to be kept in a fire-proof place in air-tight containers.

Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces.

See section 8 "Exposure controls/personal protection" for protective measures.

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### 7.2. Conditions for safe storage, including any incompatibilities

Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Keep all containers sealed except when opened for removal of material. Reseal containers immediately after each use to prevent contamination or, in the case of pastes, loss of solvent. The use of an inert gas to replace air can greatly increase the safety of many operations, particularly where it may be impossible to ensure that all sources of ignition are eliminated. Powder trickling out onto the floor or onto other containers must be prevented. Must be stored in a cool and well-ventilated area, away from possible sources of ignition. Avoid the suspension of dust in the air. Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use non-sparking tools.

#### Recommended storage material

Always store in containers of the same material as the original container.

#### Storage temperature

Store in tightly closed original container in a dry, cool and well-ventilated place. Store in accordance with local regulations.

#### Incompatible materials

Strong acids, strong bases, strong oxidizing agents, and strong reducing agents.

### 7.3. Specific end use(s)

This product should only be used for applications quoted in section 1.2.

## SECTION 8: Exposure controls/personal protection

### 8.1. Control parameters

#### Aluminium

Long term exposure limit (OSHA Table Z-1) (mg/m<sup>3</sup>): 15 Total dust / 5 Respirable fraction

Long term exposure limit (ACGIH TLV) (mg/m<sup>3</sup>): 1 Respirable fraction

Long term exposure limit (NIOSH REL) (mg/m<sup>3</sup>): 10 (Total dust), 5 (Respirable fraction)

Part 1910 - Occupational Safety and Health Standards (29 CFR 1910.1000 TABLE Z-1 - Limits for Air Contaminants)

### 8.2. Exposure controls

Compliance with the given occupational exposure limits values should be controlled on a regular basis. Where necessary use lighting and electrical equipment designed for use in atmospheres where flammable vapours or dusts are present, and which can direct static electricity by grounding equipment.

#### General recommendations

When transferring the materials, dust clouds should be kept at an absolute minimum. Handling should be slow and deliberate. The materials should be transferred from one container to another using a non-sparking, conductive metal scoop.

When mixing the material with other dry ingredients, frictional heat should be avoided. The best type of mixer for a dry mixing operation is one that contains no moving parts, but rather affects a tumbling action, such as a conical blender. Introduction of an inert atmosphere in the blender is highly recommended since dust clouds are generated. All equipment must be well grounded.

Smoking, drinking and consumption of food is not allowed in the work area.

#### Exposure scenarios

There are no exposure scenarios implemented for this product.

#### Exposure limits

Professional users are subjected to the legally set maximum concentrations for occupational exposure. See occupational hygiene limit values above.

#### Appropriate technical measures

All electrical wiring, lights and equipment must be as specified by the latest version of the National Electrical Code, NFPA 70. Some locations may require electrical installations suitable for Class I or Class II locations per articles 500 through 504 of NFPA 70.

#### Hygiene measures

In between use of the product and at the end of the working day all exposed areas of the body must be washed thoroughly. Always wash hands, forearms and face.

#### Measures to avoid environmental exposure

No specific requirements.

### 8.3. Individual protection measures, such as personal protective equipment

#### Generally

Work clothing should be made of smooth, closely woven fire resistant/fire retardant fabrics which tend not to accumulate static electric charges. Trousers should have no cuffs where the material might accumulate. Pockets, if

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present, should be designed in such a way as to eliminate the accumulation of dust.  
Use only protective equipment with a recognized certification mark, e.g. the UL mark.



#### Respiratory Equipment

Type	Class	Colour	Standards
SL	P3	White	EN149




#### Skin protection

Recommended	Type/Category	Standards
Dedicated work clothing should be worn. Wear a protective suit in the event of prolonged periods of work with the product.	-	-
Safety shoes		EN ISO 20345


#### Hand protection

Material	Glove thickness (mm)	Breakthrough time (min.)	Standards
Butyl	0,3	> 480	EN374-2, EN374-3, EN388



#### Eye protection

Type	Standards
Safety glasses with side shields.	EN166



## SECTION 9: Physical and chemical properties

### 9.1. Information on basic physical and chemical properties

#### Physical state

Powder

#### Colour

Gray

#### Odour

None

#### Odour threshold (ppm)

Testing not relevant or not possible due to the nature of the product.

#### pH

Not applicable - product is a solid

#### Density (g/cm<sup>3</sup>)

≈ 4.43

#### Relative density

No information available as testing has not been completed.

#### Kinematic viscosity

Not applicable - product is a solid

#### Phase changes

##### Melting point (°F)

-

##### Melting point (°C)

1605 - 1660

##### Boiling point (°F)

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No information available as testing has not been completed.

**Vapour pressure**

Testing not relevant or not possible due to the nature of the product.

**Vapour density**

Does not apply to solids.

**Decomposition temperature (°F)**

No information available as testing has not been completed.

**Evaporation rate (n-butylacetate = 100)**

Not applicable - product is a solid

**Data on fire and explosion hazards**

**Flash point (°F)**

Not applicable - product is a solid

**Ignition (°F)**

-

**Ignition (°C)**

≈ 493

**Auto flammability (°F)**

-

**Auto flammability (°C)**

≈ 325

**Explosion limits (% v/v)**

No information available as testing has not been completed.

**Solubility**

**Solubility in water**

Insoluble

**n-octanol/water coefficient**

No information available as testing has not been completed.

**9.2. Other information**

**Solubility in fat (g/L)**

No information available as testing has not been completed.

**SECTION 10: Stability and reactivity**

**10.1. Reactivity**

No data available.

**10.2. Chemical stability**

The product is stable under the conditions, noted in section 7 "Handling and storage".

**10.3. Possibility of hazardous reactions**

None known.

**10.4. Conditions to avoid**

Avoid static electricity.

Avoid the suspension of dust in the air.

**10.5. Incompatible materials**

Strong acids, strong bases, strong oxidizing agents, and strong reducing agents.

**10.6. Hazardous decomposition products**

The product is not degraded when used as specified in section 1.

**SECTION 11: Toxicological information**

**11.1. Information on toxicological effects**

**Acute toxicity**

Product/substance	Titanium
Test method:	OECD 425
Species:	Rat
Route of exposure:	Oral
Test:	LD50
Result:	>5000 mg/kg bw/day
Other information:	

Product/substance	Vanadium
Test method:	OECD 423

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Species: Rat  
Route of exposure: Oral  
Test: LD50  
Result: >2000 mg/kg bw/day  
Other information:

Product/substance Vanadium  
Test method: OECD 436  
Species: Rat  
Route of exposure: Inhalation  
Test: LC50 (4 hours)  
Result: >5.05 mg/L  
Other information:

#### Skin corrosion/irritation

Based on available data, the classification criteria are not met.

#### Serious eye damage/irritation

Based on available data, the classification criteria are not met.

#### Respiratory sensitisation

Based on available data, the classification criteria are not met.

#### Skin sensitisation

Based on available data, the classification criteria are not met.

#### Germ cell mutagenicity

Based on available data, the classification criteria are not met.

#### Carcinogenicity

Based on available data, the classification criteria are not met.

#### Reproductive toxicity

Based on available data, the classification criteria are not met.

#### STOT-single exposure

Based on available data, the classification criteria are not met.

#### STOT-repeated exposure

Based on available data, the classification criteria are not met.

#### Aspiration hazard

Based on available data, the classification criteria are not met.

#### Long term effects

None known.

#### Other information

None known.

Exposure to metal dusts and oxides may cause metal fume fever. Metal fume fever is a temporary flu-like condition characterized by chills, fever, muscle aches and pains, nausea, and vomiting. Typically, the symptoms appear within a few hours after exposure and subside within 2-3 days with no permanent effects.

## SECTION 12: Ecological information

### 12.1. Toxicity

Product/substance Titanium  
Test method:  
Species: Algae, Skeletonema costatum  
Compartment:  
Duration: 72 hours  
Test: EC50  
Result: >10000 mg/L  
Other information:

Product/substance Vanadium  
Test method: OECD 203  
Species: Fish, Leuciscus idus  
Compartment:  
Duration: 96 hours  
Test: LC50  
Result: 693 µg/L  
Other information:

Product/substance Vanadium

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Test method: OECD 201  
Species: Algae, Desmodesmus subspicatus  
Compartment:  
Duration: 72 hours  
Test: ErC50  
Result: 2907 µg/L  
Other information:

**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. Results of PBT and vPvB assessment**

This mixture/product does not contain any substances considered to meet the criteria classifying them as PBT and/or vPvB.

**12.6. Other adverse effects**

None known.

**SECTION 13: Disposal considerations**

**RCRA Hazardous waste ("P" and "U" list) (40 CFR 261)**

None of the components are listed




**Specific labelling**

Not applicable.

**Contaminated packing**

Packaging containing residues of the product must be disposed of similarly to the product.

**SECTION 14: Transport information**

	<b>14.1 UN / ID</b>	<b>14.2 UN proper shipping name</b>	<b>14.3 Hazard class(es) Labels: 4.1 Classification code: F3</b>	<b>14.4 PG*</b>	<b>14.5 Env**</b>	<b>Other information:</b>
DOT	UN3089	METAL POWDER, FLAMMABLE, N.O.S.	Class: 4.1 Labels: 4.1 Classification code: F3 	II	No	Limited quantities: 1 kg Tunnel restriction code: (E) See below for additional information.
IMDG	UN3089	METAL POWDER, FLAMMABLE, N.O.S.	Class: 4.1 Labels: 4.1 Classification code: F3 	II	No	Limited quantities: 1 kg EmS: F-G S-G See below for additional information.
IATA	UN3089	METAL POWDER, FLAMMABLE, N.O.S.	Class: 4.1 Labels: 4.1 Classification code: F3 	II	No	See below for additional information.

\* Packing group

\*\* Environmental hazards

**Additional information**

ADR / See Table A, Section 3.2.1 for any information on special provisions, requirements, or warnings in connection



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with transport. See section 5.4.3, for instructions in writing regarding mitigation of damages in relation to incidents or accidents during transport.

IMDG / See section 3.2.1, for any information on special provisions, requirements, or warnings in connection with transport.

IATA / See Table 4.2 for any information on special provisions, requirements, or warnings in connection with transport.

This product is within scope of the regulations of transport of dangerous goods.

#### 14.6. Special precautions for user

Not applicable.

#### 14.7. Transport in bulk according to Annex II of Marpol and the IBC Code

No data available.

### SECTION 15: Regulatory information

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

#### 15.2. U.S. Federal regulations

##### TSCA

Titanium is listed in the non-confidential portion

Aluminium is listed in the non-confidential portion

Vanadium is listed in the non-confidential portion

##### Clean Air Act

None of the components are listed

##### EPCRA Section 302

None of the components are listed

##### EPCRA Section 304

None of the components are listed

##### EPCRA section 313

Aluminium is listed

Vanadium is listed

##### CERCLA

None of the components are listed

#### State regulations

##### California / Prop. 65

None of the components are listed

##### Massachusetts / Right To Know Act

Aluminium is listed

Vanadium is listed

##### New Jersey / Right To Know Act

Titanium / Substance number: 1860

Titanium is on the Special Health Hazard Substance List

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Aluminium / Substance number: 0054

Aluminium is on the Special Health Hazard Substance List

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Vanadium / Substance number: 3762

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##### New York / Right To Know Act

Titanium is listed

Titanium is regulated with a Treshold Reporting Quantity (TRQ) of: 10 pounds

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Aluminium is listed

Aluminium is regulated with a Treshold Reporting Quantity (TRQ) of: 1 pounds

—

Vanadium is listed

Vanadium is regulated with a Treshold Reporting Quantity (TRQ) of: 10 pounds

—

##### Pennsylvania / Right To Know Act

Aluminium is listed

Aluminium is hazardous to the environment (E)

—

Vanadium is listed

Vanadium is hazardous to the environment (E)

15.4. Restrictions for application

Restricted to professional users.

15.5. Demands for specific education

No specific requirements.

15.6. Additional information

Not applicable.

15.7. Chemical safety assessment

No

15.8. Sources

OSHA Hazard Communication Standard (29 CFR 1910.1200)

SECTION 16: Other information

Full text of H-phrases as mentioned in section 3

H228, Flammable solid.

H261, In contact with water releases flammable gases.

The full text of identified uses as mentioned in section 1

None known.

Abbreviations and acronyms

ACGIH = American Conference of Governmental Industrial Hygienists

ADN = European Provisions concerning the International Carriage of Dangerous Goods by Inland Waterway

ADR = The European Agreement concerning the International Carriage of Dangerous Goods by Road

ATE = Acute Toxicity Estimate

BCF = Bioconcentration Factor

CAS = Chemical Abstracts Service

CERCLA = Comprehensive Environmental Response Compensation and Liability Act

EINECS = European Inventory of Existing Commercial chemical Substances

EPCRA = Emergency Planning and Community Right-To-Know Act

GHS = Globally Harmonized System of Classification and Labelling of Chemicals

HCIS = Hazardous Chemical Information System

IARC = International Agency for Research on Cancer

IATA = International Air Transport Association

IMDG = International Maritime Dangerous Goods

LogPow = logarithm of the octanol/water partition coefficient

MARPOL = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)

NFPA = National Fire Protection Association

NIOSH = National Institute for Occupational Safety and Health

OECD = Organisation for Economic Co-operation and Development

OSHA = Occupational Safety and Health Administration

PBT = Persistent, Bioaccumulative and Toxic

RCRA = Resource Conservation and Recovery Act

RID = The Regulations concerning the International Carriage of Dangerous Goods by Rail

RRN = REACH Registration Number

SARA = Superfund Amendments and Reauthorization Act

SCL = A specific concentration limit.

STEL = Short-term exposure limits

STOT-RE = Specific Target Organ Toxicity - Repeated Exposure

STOT-SE = Specific Target Organ Toxicity - Single Exposure

TSCA = The Toxic Substances Control Act

TWA = Time weighted average

UN = United Nations

UVBC = Unknown or variable composition, complex reaction products or of biological materials

VOC = Volatile Organic Compound

vPvB = Very Persistent and Very Bioaccumulative

Additional information

The classification of the mixture in regard to physical hazards has been based on experimental data.

The safety data sheet is validated by

EcoOnline

Other

A change (in proportion to the last essential change (first cipher in SDS version, see section 1)) is marked with a blue triangle.

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The information in this safety data sheet applies only to this specific product (mentioned in section 1) and is not necessarily correct for use with other chemicals/products.  
It is recommended to hand over this safety data sheet to the actual user of the product. Information in this safety data sheet cannot be used as a product specification.  
Country-language: US-en