



Material Safety Data Sheet

Version 2.1

Revision Date 07/28/2011

MSDS Number 30000005299

Print Date 11/19/2011

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : TiCl₄

Chemical formula : TiCl₄

Synonyms : Titanium chloride

Product Use Description : Semiconductor Processing

Manufacturer/Importer/Distributor : Air Products and Chemicals, Inc
7201 Hamilton Blvd.
Allentown, PA 18195-1501
GST No. 123600835 RT0001
QST No. 102753981 TQ0001

Telephone : 1-610-481-4911 Corporate
1-800-345-3148 Chemicals Cust Serv
1-800-752-1597 Gases/Electronics Cust Serv

Emergency telephone number (24h) : 800-523-9374 USA
+1 610 481 7711 International

2. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Weight)
Titanium Tetrachloride	7550-45-0	100 %

Concentration is nominal. For the exact product composition, please refer to Air Products technical specifications.

3. HAZARDS IDENTIFICATION

Emergency Overview

Toxic if swallowed.
Highly toxic by inhalation.
Corrosive
Reacts violently with water.
Reaction with water releases heat.
May cause thermal burns.

Potential Health Effects

Inhalation : Highly toxic by inhalation. Can cause severe eye, skin and respiratory tract

Material Safety Data Sheet

Version 2.1
Revision Date 07/28/2011

MSDS Number 30000005299
Print Date 11/19/2011

burns. Risk of serious damage to the lungs (by inhalation). May cause nose, throat, and lung irritation. Inhalation of aerosol may cause irritation to the upper respiratory tract. Very toxic by inhalation of spray mist and/or aerosols. Industrial chemicals such as this material with acute aerosol toxicity values as shown in Section 11 would not be classified as toxic by inhalation according to US domestic and international transport regulations.

- Eye contact : Causes eye burns. May cause blindness.
- Skin contact : Causes skin burns.
- Ingestion : May be fatal if swallowed. Toxic if swallowed. If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the oesophagus and the stomach.
- Chronic Health Hazard : This product contains no listed carcinogens according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater. May affect lungs.

Exposure Guidelines

- Target Organs : Skin.
Eyes.
Respiratory system.
- Symptoms : Repeated and/or prolonged exposure to low concentrations of vapors and/or aerosols may cause: Sore throat. Inhalation may provoke the following symptoms: Pulmonary irritation and edema. Symptoms may be delayed.

Aggravated Medical Condition

Eye disease Skin disorders and Allergies. Asthma.

4. FIRST AID MEASURES

- General advice : Seek medical advice. If breathing has stopped or is labored, give assisted respirations. Supplemental oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately.
- Eye contact : Hold eyelids apart, initiate and maintain gentle and continuous irrigation until the patient receives medical care. If medical care is not promptly available, continue to irrigate for one hour.
- Skin contact : Immediately remove contaminated clothing, and any extraneous chemical, if possible to do so without delay. Flush immediately with copious amounts of water. Initiate and maintain continuous irrigation until the patient receives medical care. If medical care is not promptly available, continue to irrigate for one hour. Cover wound with sterile dressing.
- Ingestion : If a person vomits when lying on his back, place him in the recovery position. Never give anything by mouth to an unconscious person. Prevent aspiration of vomit. Turn victim's head to the side.
- Inhalation : If breathing has stopped or is labored, give assisted respirations. Supplemental

Material Safety Data Sheet

Version 2.1
Revision Date 07/28/2011

MSDS Number 30000005299
Print Date 11/19/2011

oxygen may be indicated. If the heart has stopped, trained personnel should begin cardiopulmonary resuscitation immediately. Move to fresh air.

5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : The product itself does not burn.
For smaller fires, use dry chemical or carbon dioxide, do not use water. For large fires, flood fire area with water from as far as possible, using a protective barrier and appropriate personal protective equipment.
Carbon dioxide (CO2).
Dry chemical.
Dry sand.
Limestone powder.
- Extinguishing media which must not be used for safety reasons : Water.
Alcohol-resistant foam.
- Specific hazards : Downwind personnel must be evacuated. Reacts violently with water.
- Special protective equipment for fire-fighters : Avoid contact with the skin. A face shield should be worn. Use personal protective equipment. Wear self contained breathing apparatus for fire fighting if necessary.
- Further information : The product, as distributed, is noncombustible., Do not allow run-off from fire fighting to enter drains or water courses., Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations.

6. ACCIDENTAL RELEASE MEASURES

- Personal precautions : Wear suitable protective clothing, gloves and eye/face protection. Use self-contained breathing apparatus and chemically protective clothing. Evacuate personnel to safe areas.
- Environmental precautions : Construct a dike to prevent spreading.
- Methods for cleaning up : Contact Air Products' Emergency Response Center for advice. Approach suspected leak areas with caution. Absorb with inert absorbent materials such as: Dry sand. Vermiculite. Polypropylene. Place in appropriate chemical waste container.
- Additional advice : Open enclosed spaces to outside atmosphere. Protect from water. Evacuate area and do not approach spilled product . If possible, stop flow of product.

7. HANDLING AND STORAGE

Handling

Use only in well-ventilated areas. Avoid breathing vapors and/or aerosols. Avoid contact with skin and eyes. Emergency showers and eye wash stations should be readily accessible. Adhere to work practice rules established by government regulations. Use personal protective equipment. When using, do not eat, drink or smoke.

Material Safety Data Sheet

Version 2.1
Revision Date 07/28/2011

MSDS Number 30000005299
Print Date 11/19/2011

Storage

Store in an area suitable for water reactive materials. Minimize exposure to air. Exposure may cause material to degrade. Store under a nitrogen atmosphere.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Provide readily accessible eye wash stations and safety showers.
Provide natural or explosion-proof ventilation adequate to ensure concentrations are kept below exposure limits.

Personal protective equipment

- Respiratory protection : Wear appropriate respirator when ventilation is inadequate. Use an NIOSH/MSHA approved respirator with acid gas/HEPA cartridges when exposure is possible.
- Hand protection : Impervious gloves.
Butyl-rubber
Rubber gloves.
Nitrile rubber.
The breakthrough time of the selected glove(s) must be greater than the intended use period.
- Eye protection : Full face shield with goggles underneath.
- Skin and body protection : Impervious clothing.
Full rubber suit (rain gear).
Rubber or plastic boots.
Use chemically protective clothing.
Wear as appropriate:
apron
boots
Slicker Suit.
- Special instructions for protection and hygiene : Wash at the end of each workshift and before eating, smoking or using the toilet.
Provide readily accessible eye wash stations and safety showers.

Exposure limit(s)

Titanium Tetrachloride	Time Weighted Average (TWA): WEEL	-	0.5 mg/m ³
Titanium Tetrachloride	Ceiling Limit Value and Time Period (if specified): NIOSH	-	0.05 mg/m ³

9. PHYSICAL AND CHEMICAL PROPERTIES

Form : Liquid.

Material Safety Data Sheet

Version 2.1
Revision Date 07/28/2011

MSDS Number 30000005299
Print Date 11/19/2011

Color	: Colorless.
Odor	: Pungent.
Molecular Weight	: 189.7 g/mol
Relative vapor density	: 6.5 (air = 1) Heavier than air.
Relative density	: 1.726 (water = 1)
Vapor pressure	: 9.62 mmHg at 68 °F (20 °C)
Boiling point/range	: 278 °F (136.4 °C)
Melting point/range	: -13 °F (-25 °C)
Flash point	: Does not flash.
Upper flammability limit	: Not applicable.
Lower flammability limit	: Not applicable.
Water solubility	: Reacts violently with water.

10. STABILITY AND REACTIVITY

Chemical Stability	: Stable under normal conditions.
Conditions to avoid	: Exposure to moisture. Reaction with water releases heat. May cause thermal burns.
Materials to avoid	: Humid air. Water. Strong oxidizing agents. Alkali metals. Hydrogen fluoride.
Hazardous decomposition products	: Hazardous combustion products: Titanium oxides. Hydrogen chloride gas. Hydrolysis products: Titanium dioxide. Hydrogen chloride
Possibility of hazardous reactions	: Reacts violently with water.

11. TOXICOLOGICAL INFORMATION

Acute Health Hazard

Material Safety Data Sheet

Version 2.1
Revision Date 07/28/2011

MSDS Number 30000005299
Print Date 11/19/2011

- Ingestion : LD50 : < 464 mg/kg Species : Rat.
- Inhalation : LC50 (4 h) : 0.46 mg/l Species : Rat.
(as aerosol) Prolonged and/or repeated inhalation may cause severe respiratory irritation, pulmonary edema, respiratory tract inflammation and pulmonary fibrosis.
- Dermal : LD50 : 3,160 mg/kg Species : Rabbit.
- Eye irritation/corrosion : Severe eye irritation., Extremely corrosive and destructive to tissue.
- Skin irritation/corrosion : Severe skin irritation., Extremely corrosive and destructive to tissue.

Chronic Health Hazard

In inhalation toxicity studies in rats at an exposure level of 0.04 mg/L for 6 hours per day for 5 days, produced decreased weight gain, inflammation of the respiratory tract, pulmonary fibrosis and 8% mortality. Similar treatment at 0.005 mg/L showed no treatment related effects.

12. ECOLOGICAL INFORMATION

Ecotoxicity effects

- Aquatic toxicity : No data is available on the product itself.
- Toxicity to other organisms : No data available.

Persistence and degradability

- Biodegradability : No data is available on the product itself.
- Mobility : No data available.
- Bioaccumulation : No data is available on the product itself.

13. DISPOSAL CONSIDERATIONS

- Waste from residues / unused products : Contact supplier if guidance is required.
- Contaminated packaging : Dispose of container and unused contents in accordance with federal, state, and local requirements.

14. TRANSPORT INFORMATION

DOT

- UN/ID No. : UN1838
- Proper shipping name : Titanium tetrachloride

Material Safety Data Sheet

Version 2.1
Revision Date 07/28/2011

MSDS Number 30000005299
Print Date 11/19/2011

Class or Division : 6.1
Packing group : I
Label(s) : 6.1 (8)
PIH Zone : B

IATA

Transport Forbidden

IMDG

UN/ID No. : UN1838
Proper shipping name : TITANIUM TETRACHLORIDE
Class or Division : 6.1
Packing group : I
Label(s) : 6.1 (8)

TDG

UN/ID No. : UN1838
Proper shipping name : TITANIUM TETRACHLORIDE
Class or Division : 8
Packing group : II
Label(s) : 8

Further Information

The transportation information is not intended to convey all specific regulatory data relating to this material. For complete transportation information, contact an Air Products customer service representative.

15. REGULATORY INFORMATION

Toxic Substance Control Act (TSCA) 12(b) Component(s):

None.

OSHA Hazard Communication Standard (29 CFR 1910.1 200) Hazard Class(es)

Highly Toxic. Water Reactive Corrosive.

Country	Regulatory list	Notification
USA	TSCA	Included on Inventory.
EU	EINECS	Included on EINECS inventory or polymer substance, monomers included on EINECS inventory or no longer polymer.
Canada	DSL	Included on Inventory.
Australia	AICS	Included on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Included on Inventory.
Philippines	PICCS	Included on Inventory.

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification

Acute Health Hazard Reactivity Hazard.

Material Safety Data Sheet

Version 2.1
Revision Date 07/28/2011

MSDS Number 30000005299
Print Date 11/19/2011

US. California Safe Drinking Water & Toxic Enforcement Act (Proposition 65)

This product does not contain any chemicals known to State of California to cause cancer, birth defects or any other harm.

16. OTHER INFORMATION

NFPA Rating

Health : 3
Fire : 0
Instability : 2
Special : W

HMIS Rating

Health : 3
Flammability : 0
Physical hazard : 2

Prepared by : Air Products and Chemicals, Inc. Global EH&S Product Safety Department

Telephone : 1-610-481-4911 Corporate
1-800-345-3148 Chemicals Cust Serv
1-800-752-1597 Gases/Electronics Cust Serv

Preparation Date : 11/19/2011

For additional information, please visit our Product Stewardship web site at
<http://www.airproducts.com/productstewardship/>
