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Material Safety Data Sheet

Identity: Titanium Sputtering Target

Formula: Ti

SECTION I - GENERAL INFORMATION

Manufacturer: Advanced Engineering Materials Limited (AEM)

The information below is believed to be accurate and represents the best information available to AEM. However, AEM makes no warranty, expressed or implied with respect to such information and assumes no liability resulting from its use.

SECTION II - HAZARDOUS INGREDIENTS/IDENTITY INFORMATION

Molecular weight: 47.88

| CAS # | OSHA PEL | OTHER LIMITS | SEC.302 (EHS) | SEC.313 | % |
|-----------|----------|--------------|---------------|---------|----------|
| 7440-32-6 | NE | NE | NO | NO | 0.0-100% |

| ACGIH TLV | SEC.304RO |
|-----------|-----------|
| NE | NO |

SECTION III - PHYSICAL/CHEMICAL CHARACTERISTICS

Physical States: Titanium metal, powder and pieces (<75 microns) (Solid)

| | |
|--|--|
| Boiling Point: 3287.00C (5948.6F) | Vapor Pressure (VS. AIR OR MM HG) 0 at 20.0 (68.0 F) |
| Melting Point: 1650.00C (3002.0F) to (1670.00C) (3038.0F) | Density: No Data |
| Evaporation Rate: No Data | Percent Volatile: N.A. |
| Solubility in water: insoluble | Other Solubility Notes: decomposes steam at 700-800C |
| Vapor Density (VS. Air = 1): No Data | PH: No Data |
| Evaporation Rate (VS Butyl Acetate =1): No Data | |

Appearance and odor: Dark gray powder or silver-gray pieces, no odor.

SECTION IV - FIRE AND EXPLOSION HAZARD DATA:

METHOD USED: No Data *Explosive Limits:* LEL: N/A UEL: N/A

AUTOIGNITION PT: 1200.00C (2192.0F)

EXTINGUISHING MEDIA

AUTOIGNITION POINT: 1200C for solid metal in air 250C for powder in air

USE: Class D, inert gas (argon or helium) or other metal extinguishing agent.

DO NOT USE: Water or carbon dioxide. Water applied to hot titanium may evolve hydrogen, causing an explosion.



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Special Fire Fighting Procedures:

Firefighters must wear full face, self-contained breathing apparatus with full protective clothing to prevent contact with skin and eyes. Fumes from fire are hazardous. Isolate runoff to prevent environmental pollution.

Unusual Fire and Explosion Hazards:

May burn in an atmosphere of carbon dioxide, nitrogen or air. May react violently with BrF₃; CuO; PbO; (Ni+KClO₃), metaloxy salts; halocarbons; halogens; CO₂ metal carbonates; Al; AgF; O₂; nitryl fluoride; HN0₃; O₂; KClO₃; KN0₃; KMn0₄; steam at 704F; trichloroethylene,; trichlorotri-fluoroethane. Titanium, in the absence of moisture, burns slowly, but evolves much heat.

Water applied to hot titanium may evolve hydrogen, causing an explosion.

| |
|-----------------------------|
| SECTION V - REACTIVITY DATA |
|-----------------------------|

Stability: Unstable [] Stable [X]

Conditions to Avoid (stability): Dispersion in air

Incompatibility- Materials to Avoid

TITANIUM: Air BrF₃; CuO, PbO, (Ni + KClO₃), metaloxy salts, halocarbons, halogens, CO₂, metal carbonates, Al, AgF, O₂ nitryl fluoride, HN0₃, KClO₃, KN0₃, KMn0₄, steam (>700C), trichloroethylene, trichlorotri-fluoroethane, oxygen, carbon black, carbon dioxide and nitrogen, sodium chlorate.

Water applied to hot Titanium may evolve hydrogen, causing an explosion.

Hazardous Decomposition or Byproducts:

Metal fumes and titanium oxides *Hazardous*

Polymerization:

Will occur [] Will not occur [X]

Conditions to avoid (hazardous polymerization):

None

| |
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| SECTION VI - HEALTH HAZARD DATA |
|---------------------------------|

Titanium metal, powder and pieces (>75 microns)

Routes of entry: Inhalation? Yes Skin? No Eyes? No Ingestion? No Other? N

HEALTH HAZARDS (ACUTE AND CHRONIC)

TITAMIUM: This materials is generally considered to be physiologically inert. There are no reported cases in the literature where titanium as such has caused human intoxication. The dusts of titanium or most titanium compounds such a titanium oxide may be placed in the nuisance category. (Sax, Dangerous Properties of Industrial Materials, eight edition).



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Health Hazards (Acute and Chronic):

Inhalation:

Acute: Prolonged inhalation may cause mild irritation to the lungs and respiratory tract.

Chronic: May cause fibrotic lung changes.

Ingestion:

Acute: Relatively non-toxic, poorly absorbed from the alimentary tract.

Chronic: No chronic health effects recorded.

Skin:

Acute: May cause abrasive irritation. Chronic:

No chronic health effects recorded.

Eye:

Acute: May cause abrasive irritation. Chronic:

No chronic health effects recorded.

Target Organs: No target organs recorded.

Carcinogenicity: NTP? No IARC Monographs? No OSHA Regulated? No

Carcinogenicity/Other Information

Questionable carcinogen with experimental tumorigenic data. Experimental reproductive effects.

oral-rat TDLO: 158mg/kg multi: Reproductive effects

Intramuscular-rat TDLO: 114 mg/kg/77W-I: Equivocal

Tumorigenic Agent

Intramuscular-rat TD: 360 mg/kg/69W-I: Equivocal Tumorigenic Agent

RECOMMENDED EXPOSURE LIMITS: See "Section II"

LD 50/LC50: "Carcinogenicity/Other Information"

SIGNS AND SYMPTOMS OF EXPOSURE

INHALATION: Prolonged exposure may cause a red, dry, throat, coughing and shortness of breath.

INGESTION: No acute or chronic health effects recorded.

SKIN: May cause redness and itching.

EYE: May cause redness, itching and watering.

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE

None recorded.

EMERGENCY AND FIRST AID PROCEDURES

INHALATION: Remove victim to fresh air; keep warm and quiet; give oxygen if breathing is difficult and seek medical attention if symptoms persist.

INGESTION: Give 1-2 glasses of milk or water and induce vomiting; Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing; brush material off skin; wash affected area with mild soap and water; seek medical attention if symptoms persist.

EYE: Flush eyes with lukewarm water, lifting upper and lower eyelids, for at least 15 minutes. Seek medical attention if symptoms persist.

NOTE TO PHYSICIAN

No data available.



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SECTION VII - PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be taken in case material is released or spilled:

Wear appropriate respiratory and protective equipment specified in section VIII – control measures. Isolate spill area, provide ventilation. Vacuum up spill using a high efficiency particulate absolute (HEPA) air filter and place in a closed container for proper disposal. Take care not to raise dust.

Waste disposal method:

Dispose of in accordance with state, local, and federal regulations.

Hazard Label Information:

Store in cool, dry area and in tightly sealed container. Wash thoroughly after handling.

PRECAUTIONS TO BE TAKEN IN HANDLING

Do not disperse powder or dust in the air.

PRECAUTIONS TO BE TAKEN IN STORING

None

OTHER PRECAUTIONS

None

SECTION VIII - CONTROL MEASURES

PROTECTIVE EQUIPMENT SUMMARY (Hazard Label Information):

NIOSH approved respirator, impervious gloves, and safety glasses.

RESPIRATORY EQUIPMENT (SPECIFY TYPE)

NIOSH approved respirator

VENTILATION:

Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels.

Powders under 74 microns are flammable.

EYE PROTECTION

Safety glasses

PROTECTIVE GLOVES

Rubber gloves

OTHER PROTECTIVE CLOTHING

Protective gear suitable to prevent contamination

WORK/HYGIENIC/MAINTENANCE PRACTICES

Implement engineering and work practice controls to reduce and maintain concentration of exposure at low levels. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating and smoking. Do not blow dust off clothing or skin with compressed air.

WORK/HYGENIC/MAINTENANCE PRACTICES:

Implement engineering and work practice controls to reduce and maintain concentration of exposure at low levels. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Do not blow dust off clothing or skin with compressed air.

Please be advised that N/A can either mean Not Applicable or No Data Has Been Established