

Safety Data Sheet

Version 3.0

Revision Date 12/08/2016

SDS Number 300000005263

Print Date 03/18/2017

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : HFCL4

Chemical formula : HfCl4

Synonyms : Hafnium Tetrachloride;Hafnium(IV) Chloride;Tetrachlorohafnium; Hafnium Chloride

Product Use Description : Semiconductor Processing

Manufacturer/Importer/Distributor : Versum Materials US, LLC
7201 Hamilton Blvd.
Allentown, PA 18195-1501
Exporter EIN No.475632014
www.versummaterials.com

Telephone : (610)481-4911

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

2. HAZARDS IDENTIFICATION

GHS classification

Skin corrosion - Category 1B
Serious Eye Damage - Category 1
Skin sensitization - Category 1

GHS label elements

Hazard pictograms/symbols



Signal Word: Danger

Hazard Statements:

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H314:Causes severe skin burns and eye damage.

H317:May cause an allergic skin reaction.

Precautionary Statements:

- Prevention : P260a:Do not breathe dust or mist.
P264:Wash hands thoroughly after handling.
P280:Wear protective gloves/protective clothing/eye protection/face protection.
- Response : P301+P330+P331 :IF SWALLOWED: rinse mouth. Do NOT induce vomiting.
P303+P361+P353 :IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
P305+P351+P338 :IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310 :Immediately call a POISON CENTRE/doctor.
P333+P313 :If skin irritation or rash occurs: Get medical advice/attention.
P363 :Wash contaminated clothing before reuse.
- Disposal : P501:Disposal of contents/container to be specified in accordance with regulations.

Hazards not otherwise classified

Decomposes in contact with water.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Weight)
Hafnium Chloride	13499-05-3	> 99%

Concentration is nominal. For the exact product composition, please refer to technical specifications. Contains no other components or impurities which will influence the classification of the product.

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. 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.

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Ingestion	: If a person vomits when lying on his back, place him in the recovery position. Do not induce vomiting without medical advice. Never give anything by mouth to an unconscious person. Do not induce vomiting. If vomiting occurs naturally, have victim lean forward to reduce risk of aspiration. Prevent aspiration of vomit. Turn victim's head to the side.
Inhalation	: 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. Move to fresh air.
Most important symptoms/effects - acute and delayed	: Repeated and/or prolonged exposure to low concentrations of vapors and/or aerosols may cause: Sore throat. Breathing difficulties. Nausea. Cough. Vomiting. Abdominal pain. Sneezing. Dermatitis. Symptoms may be delayed. Asthma. Eye disease. Skin disorders and Allergies.

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	: Potential dust explosion hazard. Mixing any dust that can propagate a deflagration with flammable vapor will increase the hazard rating. Where explosive dusts are contained in equipment, that equipment should contain adequate explosion relief vents, explosion suppression systems, or an oxygen-deficient atmosphere. Care should be taken to prevent the escape of dust from horizontal surfaces. Downwind personnel must be evacuated. Decomposes in contact 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	: 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., The product, as distributed, is noncombustible.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions,	: Wear suitable protective clothing, gloves and eye/face protection. Use self-
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Protective Equipment, and Emergency Procedures	contained breathing apparatus and chemically protective clothing. Evacuate personnel to safe areas.
Environmental precautions	: Construct a dike to prevent spreading.
Methods for cleaning up	: Approach suspected leak areas with caution. Call Emergency Response number for advice. Place in appropriate chemical waste container.
Additional advice	: Open enclosed spaces to outside atmosphere. Protect from water. If possible, stop flow of product.

7. HANDLING AND STORAGE

Handling

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

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.

Storage Temperature : 32 - 104 °F (0 - 40 °C)

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. Respirator must be worn if exposed to dust. Use a NIOSH air purifying respirator with acid gas/dust/mist, high-efficiency particulate (HEPA) filter cartridges when exposure is likely.
Hand protection	: Impervious gloves. Neoprene gloves. Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.
Eye protection	: Full face shield with goggles underneath. Dust resistant safety goggles. Chemical resistant goggles must be worn.

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Skin and body protection : Slicker Suit.
Impervious clothing.
Full rubber suit (rain gear).
Rubber or plastic boots.
Long sleeve shirts and trousers without cuffs.

Special instructions for protection and hygiene : Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Provide readily accessible eye wash stations and safety showers.
Wash hands 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)

Hafnium Chloride	Time Weighted Average (TWA): ACGIH	-	0.5 mg/m3
Hafnium Chloride	Recommended exposure limit (REL): NIOSH	-	0.5 mg/m3

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Powder. Beige.

Odor : slight chlorine

Odor threshold : No data available.

pH : Not applicable.

Melting point/range : No data available.

Flash point : Does not flash.

Evaporation rate : Not applicable.

Flammability (solid, gas) : Refer to product classification in Section 2

Upper/lower explosion/flammability limit : Not applicable.

Vapor pressure : No data available.

Water solubility : Hydrolyses.
Decomposes in contact with water.

Relative vapor density : Not applicable.

Relative density : No data available.

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Partition coefficient (n-octanol/water)	: Not applicable.
Auto-ignition temperature	: No data available.
Decomposition temperature	: No data available.
Viscosity	: Not applicable.
Molecular Weight	: 320.3 g/mol
Sublimation point	: 608 °F (320 °C)

10. STABILITY AND REACTIVITY

Chemical Stability	: Stable under normal conditions.
Conditions to avoid	: Exposure to moisture. Heat, flames and sparks.
Materials to avoid	: Humid air. Water. Aluminium. Alkaline earth metals. Amines. Alcohols. Aluminum alloys. Magnesium. Strong alkaline solutions.
Hazardous decomposition products	: Hazardous combustion products: Hafnium oxides. Hydrogen chloride gas. Hydrolysis products: Hafnium hydroxide. Hydrogen chloride Hafnium oxychloride.
Possibility of hazardous Reactions/Reactivity	: Decomposes in contact with water. This material can react with water to generate hydrogen chloride.

11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Likely routes of exposure

Effects on Eye	: Causes eye burns. May cause blindness.
Effects on Skin	: Causes skin burns. Harmful in contact with skin. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting.

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- Inhalation Effects : Risk of serious damage to the lungs (by inhalation). Can cause severe eye, skin and respiratory tract burns. Inhalation of vapors and/or aerosols in high concentration may cause irritation of respiratory system. Harmful if inhaled. Delayed fatal pulmonary edema possible.
- Ingestion Effects : If ingested, severe burns of the mouth and throat, as well as a danger of perforation of the oesophagus and the stomach. Harmful if swallowed.
- Symptoms : Repeated and/or prolonged exposure to low concentrations of vapors and/or aerosols may cause: Sore throat. Breathing difficulties. Nausea. Cough. Vomiting. Abdominal pain. Sneezing. Dermatitis. Symptoms may be delayed. Asthma., Eye disease., Skin disorders and Allergies.

Acute toxicity

- Acute Oral Toxicity : Harmful if swallowed.

Acute Oral Toxicity - Components

Hafnium Chloride

LD50 : 2,362 mg/kg

Species : Rat.

- Inhalation : Harmful by inhalation.
- Acute Dermal Toxicity : Harmful in contact with skin.
- Skin corrosion/irritation : Skin irritation.
- Serious eye damage/eye irritation : Severe eye irritation.
- Sensitization. : May cause sensitization by skin contact.

Chronic toxicity or effects from long term exposures

- Carcinogenicity : No data available.
- Reproductive toxicity : No data is available on the product itself.
- Germ cell mutagenicity : No data is available on the product itself.
- Specific target organ systemic toxicity (single exposure) : No data available.
- Specific target organ systemic toxicity (repeated exposure) : No data available.
- Aspiration hazard : No data available.

Delayed and Immediate Effects and Chronic Effects from Short and Long Term Exposure

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This product contains no listed carcinogens according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater. Some evidence of sensitization to the skin in susceptible individuals exists. Repeated and/or prolonged exposures may result in: Liver disorders (such as jaundice or liver enlargement). Asthma. Eye disease. Skin disorders and Allergies.

In a 90-day feeding study, rats were exposed to 0, 0.01%, 0.1%, or 1% of this substance in their diet. Changes (vacuolization and granulation) were seen in the livers of almost all of the animals fed the diet containing 1% of this substance. These changes were also seen in some of the animals in the mid-dose group.

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. : UN3260
Proper shipping name : Corrosive solid, acidic, inorganic, n.o.s., (Hafnium tetrachloride)
Class or Division : 8
Packing group : II
Label(s) : 8
Marine Pollutant : No

IATA

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UN/ID No. : UN3260
Proper shipping name : Corrosive solid, acidic, inorganic, n.o.s., (Hafnium tetrachloride)
Class or Division : 8
Packing group : II
Label(s) : 8
Marine Pollutant : No

IMDG

UN/ID No. : UN3260
Proper shipping name : CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S., (Hafnium tetrachloride)
Class or Division : 8
Packing group : II
Label(s) : 8
Marine Pollutant : No

TDG

UN/ID No. : UN3260
Proper shipping name : CORROSIVE SOLID, ACIDIC, INORGANIC, N.O.S., (Hafnium tetrachloride)
Class or Division : 8
Packing group : II
Label(s) : 8
Marine Pollutant : No

Further Information

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

15. REGULATORY INFORMATION

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

None.

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	Not on Inventory.
Australia	AICS	Not on Inventory.
Japan	ENCS	Included on Inventory.
South Korea	ECL	Included on Inventory.
China	SEPA	Not on Inventory.
Philippines	PICCS	Not on Inventory.

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

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Acute Health Hazard

Chronic Health Hazard

EPA SARA Title III Section 313 (40 CFR 372) Component(s) above 'de minimus' level
None.

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 2

HMIS Rating

Health	: 3
Flammability	: 0
Physical hazard	: 2

Prepared by : Versum Materials, Product Regulatory Department

Telephone : (610)481-4911

Preparation Date : 03/18/2017

For additional information, please visit Versum Materials' Product Stewardship web site.
<http://www.versummaterials.com/productstewardship/>