

Safety Data Sheet

Version 3.0

Revision Date 12/08/2016

SDS Number 300000005264

Print Date 03/04/2017

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : HFTBX

Chemical formula : C16H36HfO4

Product Use Description : Semiconductor Processing Subject to a Low Volume Exemption for use as Precursor for production of Hf containing thin film.

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. HAZARDS IDENTIFICATION

GHS classification

Flammable liquids - Category 2
Acute toxicity - Oral Category 4
Skin irritation - Category 2
Eye irritation - Category 2A
Specific target organ toxicity - single exposure - Inhalation Category 3

GHS label elements

Hazard pictograms/symbols



Signal Word: Danger

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Hazard Statements:

H225:Highly flammable liquid and vapour.
H302:Harmful if swallowed.
H315:Causes skin irritation.
H319:Causes serious eye irritation.
H335:May cause respiratory irritation.

Precautionary Statements:

Prevention	: P210:Keep away from heat, hot surfaces, sparks, open flames, and other ignition sources. No smoking. P233:Keep container tightly closed. P240:Ground/Bond container and receiving equipment. P241:Use explosion-proof electrical/ventilating/lighting/equipment. P242:Use only non-sparking tools. P243:Take precautionary measures against static discharge. P261:Avoid breathing dust/fume/gas/mist/vapours/spray. P264:Wash hands thoroughly after handling. P270:Do not eat, drink or smoke when using this product. P271:Use only outdoors or in a well-ventilated area P280a:Wear protective gloves and eye/face protection.
Response	: P301+P312 :IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. P303+P361+P353 :IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. P304+P340 :IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. P305+P351+P338 :IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. P312 :Call a POISON CENTRE/doctor if you feel unwell. P330 :Rinse mouth. P332+P313 :If skin irritation occurs: Get medical advice/attention. P337+P313 :If eye irritation persists: Get medical advice/attention. P362 :Take off contaminated clothing and wash before re use. P370+P378 :In case of fire, use recommended extinguishing media for extinction.
Storage	: P403+P233:Store in a well-ventilated place. Keep container tightly closed. P403+P235:Store in a well-ventilated place. Keep cool. P405:Store locked up.
Disposal	: P501:Disposal of contents/container to be specified in accordance with regulations.

Hazards not otherwise classified

Keep away from heat and sources of ignition.
Flammable.

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Irritating to eyes.
Moderate skin irritant.
Reacts violently with water.
Reaction with water releases heat.
May cause thermal burns.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Components	CAS Number	Concentration (Weight)
Hafnium tert-Butoxide	2172-02-3	100 %

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 : Rinse immediately with plenty of water also under the eyelids for at least 20 minutes. Remove contact lenses.
- Skin contact : Wash off immediately with plenty of water for at least 20 minutes. Immediately remove contaminated clothing, and any extraneous chemical, if possible to do so without delay.
- Ingestion : Never give anything by mouth to an unconscious person. 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 : Move to fresh air.
- Most important symptoms/effects - acute and delayed : Headache. Nausea. Cough. Dizziness. Vomiting. Abdominal pain. Fatigue. Sneezing. Eye disease. Skin disorders and Allergies.

5. FIRE-FIGHTING MEASURES

- Suitable extinguishing media : 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.

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Extinguishing media which must not be used for safety reasons.	: Water. Alcohol-resistant foam.
Specific hazards	: Burning produces noxious and toxic fumes. Downwind personnel must be evacuated. Fire or intense heat may cause violent rupture of packages. May form explosive mixtures in air. Reacts violently with water.
Special protective equipment for fire-fighters	: 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.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures	: Wear suitable protective clothing, gloves and eye/face protection. Use self-contained breathing apparatus and chemically protective clothing. Remove all sources of ignition. Evacuate personnel to safe areas.
Environmental precautions	: Prevent spilled product from entering streams or drinking water supplies. Local authorities should be advised if significant spillages cannot be contained. Shut off or remove all ignition sources. Construct a dike to prevent spreading.
Methods for cleaning up	: Call Emergency Response number for advice. Approach suspected leak areas with caution. Absorb with inert absorbent materials such as: Dry sand. Vermiculite. Activated charcoal. Polypropylene. Place in appropriate chemical waste container.
Additional advice	: Protect from water. If possible, stop flow of product.

7. HANDLING AND STORAGE

Handling

Emergency showers and eye wash stations should be readily accessible. Adhere to work practice rules established by government regulations. Avoid contact with eyes. See "Flammable and Combustible Liquid Code" NFPA No. 30, National Fire Protection Association, Boston, MA. Use personal protective equipment. When using, do not eat, drink or smoke.

Storage

Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat and sources of ignition. Keep in a dry, cool place. Keep away from oxidizers. Store in an area suitable for water reactive materials. Minimize exposure to air. Exposure may cause material to degrade. Store under a nitrogen atmosphere. The material is light and moisture sensitive.

Technical measures/Precautions

Keep away from open flames, hot surfaces and sources of ignition.

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

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8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Engineering measures

Use explosion-proof equipment.

Apply process controls to ensure safe operating conditions. Assess potential flammability hazards based on flashpoint and potential ignition sources.

Exhaust directly to a scrubber suitable for treating organic chemical compounds.

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 : Use a NIOSH air-purifying respirator with organic vapor/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 : Chemical resistant goggles must be worn.

Skin and body protection : Long sleeve shirts and trousers without cuffs.

Environmental exposure controls : Prevent spilled product from entering streams or drinking water supplies. Local authorities should be advised if significant spillages cannot be contained. Shut off or remove all ignition sources.

Special instructions for protection and hygiene : 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.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Liquid. Colorless.

Odor : Solvent

Odor threshold : No data available.

pH : No data available.

Melting point/range : No data available.

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Boiling point/range	: 194 °F (90 °C) at 5.00 mmHg
Flash point	: No data available.
Evaporation rate	: No data available.
Flammability (solid, gas)	: Not applicable.
Upper/lower explosion/flammability limit	: Not applicable.
Vapor pressure	: 0.07 mmHg at 68 °F (20 °C)
Water solubility	: Hydrolyses. Reacts violently with water.
Relative vapor density	: Not applicable.
Relative density	: No data available.
Partition coefficient (n-octanol/water)	: No data available.
Auto-ignition temperature	: No data available.
Decomposition temperature	: No data available.
Viscosity	: No data available.
Molecular Weight	: 470.94 g/mol
Density	: 73.041 lb/ft3 (1.17 g/cm3)

10. STABILITY AND REACTIVITY

Chemical Stability	: Stable under normal conditions.
Conditions to avoid	: Heat, flames and sparks. Exposure to moisture. Reaction with water releases heat. May cause thermal burns. Exposure to light.
Materials to avoid	: Oxidizing agents. Humid air. Water. Carbon dioxide (CO2). Acids. Halogenated compounds. Reducing agents. Oxygen. Alcohols.

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Chlorinated solvents.

Hazardous decomposition products : Hazardous combustion products:
Hafnium oxides.
Carbon dioxide (CO₂).
Carbon monoxide.
Hydrolysis products:
Hafnium hydroxide.
Tert-butanol.

Possibility of hazardous Reactions/Reactivity : Reacts violently with water. Thermally decomposes to form flammable materials.

11. TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Likely routes of exposure

Effects on Eye : Contact with eyes may cause irritation.

Effects on Skin : Causes skin irritation.

Inhalation Effects : Irritating to respiratory system. May cause headache and dizziness. Causes headache, drowsiness or other effects to the central nervous system. May cause anesthetic effects.

Ingestion Effects : No data available.

Symptoms : Headache. Nausea. Cough. Dizziness. Vomiting. Abdominal pain. Fatigue. Sneezing. Eye disease., Skin disorders and Allergies.

Acute toxicity

Acute Oral Toxicity : Harmful if swallowed. Ingestion of large volumes of Hafnium tert-Butoxide may be harmful or fatal.

Inhalation : Harmful by inhalation.

Acute Dermal Toxicity : Harmful in contact with skin.

Skin corrosion/irritation : Skin irritation.

Serious eye damage/eye irritation : Eye irritation.

Sensitization. : No data available.

Chronic toxicity or effects from long term exposures

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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

This product contains no listed carcinogens according to IARC, ACGIH, NTP and/or OSHA in concentrations of 0.1 percent or greater. The main decomposition product, tert-Butanol, is listed by the ACGIH as an A4 (Not Classifiable as a Human Carcinogen) substance. Eye disease., Skin disorders and Allergies.

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.

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14. TRANSPORT INFORMATION

DOT

UN/ID No. : UN1993
Proper shipping name : Flammable liquids, n.o.s., (Hafnium tert-Butoxide)
Class or Division : 3
Packing group : II
Label(s) : 3
Marine Pollutant : No

IATA

UN/ID No. : UN1993
Proper shipping name : Flammable liquid, n.o.s., (Hafnium tert-Butoxide)
Class or Division : 3
Packing group : II
Label(s) : 3
Marine Pollutant : No

IMDG

UN/ID No. : UN1993
Proper shipping name : FLAMMABLE LIQUID, N.O.S., (Hafnium tert-Butoxide)
Class or Division : 3
Packing group : II
Label(s) : 3
Marine Pollutant : No

TDG

UN/ID No. : UN1993
Proper shipping name : FLAMMABLE LIQUID, N.O.S., (Hafnium tert-Butoxide)
Class or Division : 3
Packing group : II
Label(s) : 3
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.

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Country	Regulatory list	Notification
USA	TSCA	All components are not included in the EPA Toxic Substance Control Act (TSCA) Chemical Substance Inventory but meet the criteria for a low volume exemption (40 CFR 723.50(c)(1)).
EU	EINECS	Not on Inventory.
Canada	DSL	Not on Inventory.
Australia	AICS	Not on Inventory.
Japan	ENCS	Not on Inventory.
South Korea	ECL	Not on Inventory.
China	SEPA	Not on Inventory.
Philippines	PICCS	Not on Inventory.

EPA SARA Title III Section 312 (40 CFR 370) Hazard Classification
Acute Health Hazard Fire Hazard. Reactivity Hazard.

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 : 2
Fire : 3
Instability : 2
Special : W 2

HMIS Rating

Health : 2
Flammability : 3
Physical hazard : 2

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

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

Preparation Date : 03/04/2017

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

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