

Praxair Material Safety Data Sheet

1. Chemical Product and Company Identification

Product Name: Hafnium Oxide (MSDS No. P-6348-A)	Trade Names: Not available.
Chemical Name: Hafnium (IV) Oxide	Synonyms: Hafnia, Hafnium Dioxide
Chemical Family: Metal oxide	Product Grades: Not applicable.
Telephone:	Company Name: Praxair, Inc.
Emergencies: 1-800-645-4633*	39 Old Ridgebury Road
CHEMTREC: 1-800-424-9300*	Danbury, CT 06810-5113
Routine: 1-800-PRAXAIR	

*Call emergency numbers 24 hours a day only for spills, leaks, fire, exposure, or accidents involving this product. For routine information, contact your supplier, Praxair sales representative, or call 1-800-PRAXAIR (1-800-772-9247).

2. Hazards Identification

EMERGENCY OVERVIEW

CAUTION! Irritating powder
May cause eye and skin irritation.
May cause respiratory and digestive tract irritation.
Self-contained breathing apparatus and protective clothing
may be required by rescue workers.
Under ambient conditions, this is an odorless, white powder.

OSHA REGULATORY STATUS: This material is considered hazardous by the OSHA Hazard Communications Standard (29 CFR 1910.1200).

POTENTIAL HEALTH EFFECTS:

Effects of a Single (Acute) Overexposure

Inhalation. May cause respiratory tract irritation.

Skin Contact. May cause skin irritation.

Swallowing. May cause irritation of the digestive tract.

Eye Contact. May cause eye irritation.

Effects of Repeated (Chronic) Overexposure. Not available.

Other Effects of Overexposure. Not available.

Medical Conditions Aggravated by Overexposure. Not available.

CARCINOGENICITY: Hafnium oxide is not listed by NTP, OSHA, or IARC.

POTENTIAL ENVIRONMENTAL EFFECTS: No known effects. For further information, see section 12, Ecological Information.

3. Composition/Information on Ingredients

See section 16 for important information about mixtures.

COMPONENT	CAS NUMBER	CONCENTRATION
Hafnium Oxide	12055-23-1	≥98%*
Zirconium Oxide (as an impurity)	1314-23-4	≤2%*

*The symbol \geq means "greater than or equal to."

**The symbol \leq means "less than or equal to."

4. First Aid Measures

INHALATION: Immediately remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, qualified personnel may give oxygen. Call a physician.

SKIN CONTACT: Remove contaminated clothing and wash skin with soap and water. Wash clothing before reuse. Discard contaminated shoes and gloves. If irritation persists or contact has been prolonged, call a physician.

SWALLOWING: If swallowed and if the patient is fully conscious, wash out mouth with water. Get medical attention without delay.

EYE CONTACT: Immediately flush eyes thoroughly with water for at least 15 minutes. Hold the eyelids open and away from the eyeballs to ensure that all surfaces are flushed thoroughly. Immediately see a physician, preferably an ophthalmologist.

NOTES TO PHYSICIAN: *There is no specific antidote. Treatment of overexposure should be directed at the control of symptoms and the clinical condition of the patient.*

Exposure to zirconium, present as an impurity at ≤ 2 percent, has caused granulomatous lesions of probable allergic epitheloid origin in susceptible individuals.

5. Fire Fighting Measures

FLAMMABLE PROPERTIES: Nonflammable.

SUITABLE EXTINGUISHING MEDIA: Hafnium oxide cannot catch fire. Use media appropriate for surrounding fire.

PRODUCTS OF COMBUSTION: Not applicable. See section 10 for products of thermal decomposition.

PROTECTION OF FIREFIGHTERS: CAUTION! Irritating powder. On-site fire brigades must comply with OSHA 29 CFR 1910.156.

Specific Physical and Chemical Hazards. Heating to decomposition.

Protective Equipment and Precautions for Firefighters. Firefighters should wear self-contained breathing apparatus and full fire-fighting turnout gear.

6. Accidental Release Measures

STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED:

CAUTION! Irritating powder.

Personal Precautions. Use appropriate protective equipment as described in section 8 before attempting to clean up any spilled powder.

Environmental Precautions. Prevent waste from contaminating the surrounding environment. Keep personnel away. Discard any product, residue, disposable container, or liner in an environmentally acceptable manner, in full compliance with federal, state, and local regulations. If necessary, call your local supplier for assistance.

7. Handling and Storage

PRECAUTIONS TO BE TAKEN IN HANDLING: Use only with adequate ventilation or respiratory protection. Avoid Inhalation. Avoid contact with eyes, skin, and clothing. Avoid prolonged or repeated exposure. Have safety showers and eyewash stations available.

PRECAUTIONS TO BE TAKEN IN STORAGE: Store in a cool, dry, well-ventilated area, away from oxygen and oxidizers.

8. Exposure Controls/Personal Protection

COMPONENT	OSHA PEL	ACGIH TLV-TWA (2009)
Hafnium Oxide	0.5 mg/m ^{3*}	0.5 mg/m ^{3**}
Zirconium Oxide	5 mg/m ^{3***}	5 mg/m ^{3***} , 10 mg/m ^{3***} STEL

*The OSHA PEL for hafnium is 0.5 mg/m³.

**Hafnium and compounds, as Hf.

***Zirconium and compounds, as Zr.

TLV-TWAs should be used as a guide in the control of health hazards and not as fine lines between safe and dangerous concentrations.

IDLH = Not available.

ENGINEERING CONTROLS:

Local Exhaust. Insufficient.

Mechanical (General). Mechanical ventilation is required.

Special. None

Other. None

PERSONAL PROTECTIVE EQUIPMENT:

Skin Protection. Wear appropriate protective gloves to prevent skin exposure.

Eye/Face Protection. Wear appropriate protective eyeglasses or chemical safety goggles.

Respiratory Protection. A respiratory protection program that meet OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable) requirements must be followed whenever workplace conditions warrant respirator use. Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure (e.g., an organic vapor cartridge). For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus.

9. Physical and Chemical Properties

APPEARANCE:	White powder
ODOR:	Odorless
ODOR THRESHOLD:	Not available.
PHYSICAL STATE:	Powder at normal temperature and pressure
pH:	Not available.
MELTING POINT at 1 atm:	4996°F (2758°C)
BOILING POINT at 1 atm:	9752°F (5400°C)
FLASH POINT (test method):	Not available.
EVAPORATION RATE (Butyl Acetate = 1):	None
FLAMMABILITY:	Nonflammable
FLAMMABLE LIMITS IN AIR, % by volume:	LOWER: Not available. UPPER: Not available.
VAPOR PRESSURE at 68°F (20°C):	0.0
VAPOR DENSITY:	Not available.
SPECIFIC GRAVITY (H₂O = 1):	9.68
BULK DENSITY:	120-180 lb/ft ³ (1922-2883 kg/m ³)
SOLUBILITY IN WATER:	Insoluble
PARTITION COEFFICIENT: n-octanol/water:	Not available.
AUTOIGNITION TEMPERATURE:	Not available.
DECOMPOSITION TEMPERATURE:	Not available.
PERCENT VOLATILES BY VOLUME:	Nonvolatile
MOLECULAR WEIGHT:	210.49
MOLECULAR FORMULA:	HfO ₂

10. Stability and Reactivity

CHEMICAL STABILITY: Unstable Stable

This material is stable as shipped and stored under normal conditions, i.e., 70°F (21.1°C).

CONDITIONS TO AVOID: Heating to decomposition.

INCOMPATIBLE MATERIALS: Strong oxidizing agents.

HAZARDOUS DECOMPOSITION PRODUCTS: Thermal decomposition may generate toxic fumes and gases.

POSSIBILITY OF HAZARDOUS REACTIONS: May Occur Will Not Occur

11. Toxicological Information

ACUTE DOSE EFFECTS: No known effects.

STUDY RESULTS: None known.

12. Ecological Information

ECOTOXICITY: No known effects.

OTHER ADVERSE EFFECTS: No known ecological effects expected. Hafnium oxide does not contain any Class I or Class II ozone-depleting chemicals.

13. Disposal Considerations

WASTE DISPOSAL METHOD: Do not attempt to dispose of residual or unused quantities. Return container to supplier.

14. Transport Information

DOT/IMO SHIPPING NAME: Not applicable.

HAZARD CLASS:	NA*	PACKING GROUP/Zone:	NA*	IDENTIFICATION NUMBER:	Not applicable.	PRODUCT RQ:	None
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SHIPPING LABEL(s): Not applicable.

PLACARD (when required): Not applicable.

*NA= Not applicable.

MARINE POLLUTANTS: Hafnium oxide is not listed as a marine pollutant by DOT.

15. Regulatory Information

The following selected regulatory requirements may apply to this product. Not all such requirements are identified. Users of this product are solely responsible for compliance with all applicable federal, state, and local regulations.

U.S. FEDERAL REGULATIONS:

EPA (ENVIRONMENTAL PROTECTION AGENCY)

CERCLA: COMPREHENSIVE ENVIRONMENTAL RESPONSE, COMPENSATION, AND LIABILITY ACT OF 1980 (40 CFR Parts 117 and 302):

Reportable Quantity (RQ): None

SARA: SUPERFUND AMENDMENT AND REAUTHORIZATION ACT:

SECTIONS 302/304: Require emergency planning based on Threshold Planning Quantity (TPQ) and release reporting based on Reportable Quantities (RQ) of Extremely Hazardous Substances (EHS) (40 CFR Part 355):

TPQ: None

EHS RQ (40 CFR 355): None

SECTIONS 311/312: Require submission of MSDSs and reporting of chemical inventories with identification of EPA hazard categories. The hazard categories for this product are as follows:

IMMEDIATE: No

PRESSURE: No

DELAYED: No

REACTIVITY: No

FIRE: No

SECTION 313: Requires submission of annual reports of release of toxic chemicals that appear in 40 CFR Part 372.

Hafnium oxide is not subject to reporting under Section 313.

40 CFR 68: RISK MANAGEMENT PROGRAM FOR CHEMICAL ACCIDENTAL RELEASE PREVENTION: Requires development and implementation of risk management programs at facilities that manufacture, use, store, or otherwise handle regulated substances in quantities that exceed specified thresholds.

Hafnium oxide is not listed as a regulated substance.

TSCA: TOXIC SUBSTANCES CONTROL ACT: Hafnium oxide is listed on the TSCA inventory.

OSHA: OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION:

29 CFR 1910.119: PROCESS SAFETY MANAGEMENT OF HIGHLY HAZARDOUS CHEMICALS: Requires facilities to develop a process safety management program based on Threshold Quantities (TQ) of highly hazardous chemicals.

Hafnium oxide is not listed in Appendix A as a highly hazardous chemical.

STATE REGULATIONS:

CALIFORNIA: Hafnium oxide is not listed by California under the SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT OF 1986 (Proposition 65).

PENNSYLVANIA: Hafnium oxide is subject to the PENNSYLVANIA WORKER AND COMMUNITY RIGHT-TO-KNOW ACT (35 P.S. Sections 7301-7320).

16. Other Information

Read and understand all labels and instructions supplied with all containers of this product.

OTHER HAZARDOUS CONDITIONS OF HANDLING, STORAGE, AND USE: *Irritating powder.*

Mixtures. When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Remember, chemicals have properties that can cause serious injury or death.

HAZARD RATING SYSTEMS:

NFPA RATINGS:

HEALTH = 1
FLAMMABILITY = 0
INSTABILITY = 0
SPECIAL = None

HMIS RATINGS:

HEALTH = 1
FLAMMABILITY = 0
PHYSICAL HAZARD = 0

NOTE: The hazards of this material have not been fully investigated.

Praxair asks users of this product to study this MSDS and become aware of product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this MSDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information.

The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Material Safety Data Sheet. Since the use of this information and the conditions of use of the product are not within the control of Praxair, Inc., it is the user's obligation to determine the conditions of safe use of the product.

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