

## MATERIAL SAFETY DATA SHEET

### SECTION 1 — PRODUCT AND COMPANY IDENTIFICATION

**Product identifier:** **Hafnium Metal**

**Product use:** Insert for Air / Nitrogen Electrodes

**Supplier name and address:**

**Thermal Dynamics Corporation**

82 Benning Street  
West Lebanon, NH 03784, USA  
Phone: (603) 298-5711

**Manufacturer's name and address:**

**Teledyne Wah Chang**

PO Box 460  
Albany, OR 97321, USA  
Phone: (541) 926-4211

**24 Hour Emergency Telephone #:** (CHEMTREC) (800) 424-9300 USA / Canada  
(703) 527-3887 International

### SECTION 2 — COMPOSITION/INFORMATION ON INGREDIENTS

<u>Ingredients</u>	<u>CAS #</u>	<u>% (weight)</u>	<u>OSHA</u>	<u>ACGIH</u>	<u>LC<sub>50</sub>(rat, inh)</u>	<u>LD<sub>50</sub>(mg/kg)</u>	
			<u>PEL</u>	<u>TLV</u>	<u>(ppm/4hr)</u>	<u>rat, oral</u>	<u>dermal, rabbit</u>
Hafnium	7440-58-6	97 - 100	0.5 mg/m <sup>3</sup>	0.5 mg/m <sup>3</sup>	N/Av	N/Av	N/Av
Zirconium	7440-67-7	1 - 3	5.0 mg/m <sup>3</sup>	5.0 mg/m <sup>3</sup>	N/Av	N/Av	N/Av

### SECTION 3 — HAZARDS IDENTIFICATION

#### EMERGENCY OVERVIEW

Solid, similar in appearance to stainless steel. No odour.

Caution! Dusts or powders are flammable. No health effects expected from solid product.

Inhalation of dusts may cause respiratory irritation. Contact with dusts may cause mild, transient skin or eye irritation.

\*\*\*POTENTIAL HEALTH EFFECTS\*\*\*

**Target organs:** Eyes, skin, respiratory system

**Signs and symptoms of short-term (acute) exposure:**

*Inhalation:* No health effects expected from solid product. Inhalation of dusts may cause coughing and mild, temporary irritation.

*Skin contact:* No health effects expected from solid product. Contact with dusts may cause mild irritation as an abrasive irritant.

*Eye contact:* No health effects expected from solid product. Contact with dusts may cause mechanical irritation. Symptoms may include tearing, blinking and conjunctivitis.

*Ingestion:* No health effects expected from solid product.

**Effects of long-term (chronic) exposure:** No health effects expected from solid product. Prolonged or repeated inhalation of dusts may cause increased mucous flow and reduced lung function (pneumoconiosis). Soluble hafnium compounds have been reported to cause liver damage in lab tests on animals.

**Other important hazards:** See TOXICOLOGICAL INFORMATION, Section 11.

### SECTION 4 — FIRST AID MEASURES

**Inhalation:** If dusts are inhaled, immediately remove victim to fresh air. If irritation develops, or breathing is difficult, obtain medical attention.

**Skin contact:** Wash skin thoroughly with mild soap and running water. Obtain medical attention if irritation persists. Launder clothing before reuse. If cut, use normal first aid for cuts from sharp metal.

**Eye contact:** If dust contacts eyes, flush eyes with gently running water for at least 15 minutes. Obtain medical attention if irritation persists.

**Ingestion:** If swallowed, DO NOT induce vomiting. Obtain medical attention. Never give anything by mouth to an unconscious or convulsing person.

**SECTION 5 — FIRE FIGHTING MEASURES**

**Fire hazards/conditions of flammability:** Solid material will not ignite. Powder of 10 micron size may self-ignite at room temperature. Dust or powder may be ignited when wet. If fire starts in a mass of wet metal fines, the initial fire may be followed by an explosion and a very high temperature flash radiation.

**Flash point (Method):** N/Av

**Auto-ignition temperature:** N/Av

**Lower flammable limit (% by volume):** N/Av

**Upper flammable limit (% by volume):** N/Av

**Explosion data:** *Sensitivity to mechanical impact / static discharge:* Not expected to be sensitive to mechanical impact or static discharge under normal conditions.

**Oxidizing properties:** N/Av

**Suitable extinguishing media:** Small fires can be controlled by smothering with dry salt or Type D dry powder fire extinguishers. Carbon dioxide is not effective. Do not use water spray on fines, chips, powder or sponge, as a violent explosion may result.

**Special fire-fighting procedures/equipment:** Do not enter fire area without proper protection. Firefighters should wear proper protective equipment and a self-contained breathing apparatus. It is advisable to allow large fires to burn out, keeping the fire from spreading. Move containers from fire area if it can be done without risk. If water is used to cool fire exposed equipment, use EXTREME caution. Do NOT allow water to contact this material

**Hazardous combustion products:** Metal oxides and other irritating or toxic fumes and smoke.

**SECTION 6 — ACCIDENTAL RELEASE MEASURES**

**Personal precautions:** Restrict access to area until completion of clean-up. Ensure clean-up is conducted by trained personnel only. All persons dealing with clean-up should wear the appropriate chemically protective equipment. Keep all other personnel upwind and away from the spill/release. Refer to Section 8, EXPOSURE CONTROLS AND PERSONAL PROTECTION, for additional information on acceptable personal protective equipment.

**Environmental precautions:** Ensure spilled product does not enter drains, sewers, waterways, or confined spaces.

**Spill response/Cleanup:** Eliminate all sources of ignition. Ventilate area of release. Stop leak if you can do so without risk. Pick up material immediately using non-sparking tools. Use methods which do not generate dusts. Transfer to clean, dry, suitable containers for later disposal (see Section 13). Notify the appropriate authorities as required.

**Prohibited materials:** None known.

**SECTION 7 — HANDLING AND STORAGE**

**Safe handling procedures:** Wear appropriate protective equipment during handling. Use in a well-ventilated area. Avoid and control operations which create dusty conditions. Avoid inhalation of dusts. Avoid contact with skin, eyes, and clothing. Machining of hafnium may result in fine turnings, chips or dust. Any material with a dimension of less than 1/16 inches or a cross section less than 1/16 X 1/8, if present in any quantity, can be ignited and can sustain combustion. KEEP AWAY FROM ANY SOURCE OF IGNITION. Use non sparking tools. Keep away from incompatibles. Keep fine turnings completely dry, or very wet. If wet, the water content should be more than 25% by weight for maximum safety in handling. Severe explosions can result from ignition of hafnium powder or machining fines containing moisture in the concentration range of 5 to 10%. Do not accumulate large quantities of fines or machining residues. Dispose of these materials daily. Wash thoroughly after handling.

**Storage requirements:** Store in a cool, dry, well-ventilated area away from all sources of ignition and incompatible materials. Storage area should be clearly identified, clear of obstruction and accessible only to trained and authorized personnel. Inspect periodically for damage or leaks. No smoking in the area.

**Incompatible materials:** Hydrofluoric acid, hydrofluoric acid-nitric acid mixtures, fluorine, chlorine, bromine, iodine, halocarbons and nitril fluoride.

**Special packaging materials:** Always keep in containers made of the same materials as the supply container.

**SECTION 8 — EXPOSURE CONTROLS / PERSONAL PROTECTION**

**Ventilation and engineering controls:** Use in a well ventilated area. Use local exhaust ventilation where large amounts of dust are being formed.

**Respiratory protection:** Use a NIOSH-approved particulate respirator when conducting operations which will generate dust. In emergency situations or when concentrations are not known, a self-contained breathing apparatus may be required. Advice should be sought from respiratory protection specialists.

**SECTION 8 — EXPOSURE CONTROLS / PERSONAL PROTECTION Continued**

**Protective gloves:** Use work gloves to avoid cuts. For prolonged contact, it is recommended that protective gloves impervious to the material be worn. Confirmation of what type of material is most suitable for the intended application, should be obtained from glove suppliers.

**Eye protection:** Wear goggles or face mask when conducting operations which generate dust or flying particles.

**Other protective equipment:** Wear a reflective heat-resistant suit while burning fine scrap. An eyewash station and safety shower should be made available in the immediate working area. Other equipment may be required depending on workplace standards.

**Permissible exposure levels:** See Section 2.

**SECTION 9 — PHYSICAL AND CHEMICAL PROPERTIES**

**Physical form, colour and odour:** Solid, similar in appearance to stainless steel. No odour.

**Odour threshold:** N/Av

**Boiling point:** 4600°C / 8312°F

**Specific gravity (water=1):** 13.3

**Coefficient of oil/water distribution:** N/Av

**Solubility in water:** Insoluble

**Volatile organic compounds (VOC's):** N/Av

**pH:** N/Av

**Evaporation rate (nBuAC=1):** None

**Melting/freezing point:** 2227 +/- 20°C / 4041 °F

**Vapour pressure (mm Hg @ 20°C):** 0

**Vapour density (Air=1):** N/Av

**Percent Volatile by Weight:** 0

**SECTION 10 — STABILITY AND REACTIVITY**

**Stability and reactivity:** Stable under the recommended storage and handling conditions prescribed. Above 200°C, hafnium reacts exothermically with fluorine, chlorine, bromine, iodine and with halocarbons. Nitryl fluoride, FNO, will initiate a reaction with hafnium metal at room temperature to produce a glowing or white incandescence.

**Hazardous polymerization:** Will not occur.

**Conditions to avoid:** Processes which generate dusts.

**Materials to avoid:** Incompatible materials (see Section 7).

**Hazardous decomposition products:** Reactions with incompatible materials will generate hazardous reaction products such as flammable hydrogen, toxic fumes of nitrogen oxides, or corrosive hafnium halide vapors. Refer also to 'Hazardous combustion products', Section 5.

**SECTION 11 — TOXICOLOGICAL INFORMATION**

**Routes of exposure:** Skin contact, eye contact and inhalation.

**Toxicological data:** There is no available data for the product itself, only for the ingredients.

**LD<sub>50</sub>:** See Section 2; **LC<sub>50</sub>:** See Section 2

**Carcinogenicity:** None of the ingredients listed are classified as carcinogenic by IARC or ACGIH.

**Teratogenicity, mutagenicity, other reproductive effects:** None known.

**Sensitization to material:** None known.

**Synergistic materials:** None known.

**Conditions aggravated by exposure:** None known.

**SECTION 12 — ECOLOGICAL INFORMATION**

**Ecotoxicological information:** The ecological characteristics of this product have not been fully investigated. The product should not be allowed to enter drains or water courses or be deposited where it can affect ground or surface waters. Do not discharge product unmonitored into the environment.

**Chemical fate information:** There is no data available on the product itself.

**Aquatic toxicity:** There is no data available on the product.

**SECTION 13 — DISPOSAL CONSIDERATIONS**

**Handling for disposal:** Handle waste according to recommendations in Section 7.

**Methods of disposal:** Containers should be disposed of in accordance with all applicable federal, provincial, state, and local regulations.

**SECTION 14 — TRANSPORT INFORMATION****Canadian Transportation of Dangerous Goods Regulations (TDGR) Shipping Information:**

This product is not regulated for transportation by ground within Canada in solid form.

Hafnium powder is classified as Class 4.2 (Substances Liable to Spontaneous Combustion) when dry, and as Class 4.1 (Flammable Solids) when wet.

**US DOT 49 CFR information:**

This product is not regulated for transportation by ground within the continental United States in its solid form.

The powder would be classed as Dangerous When Wet.

**SECTION 15 — REGULATORY INFORMATION**

**WHMIS information:** In solid form, this material is not a WHMIS controlled product in Canada.

Hafnium powder is classified as WHMIS Class B4 (Flammable Solids)

*This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and this MSDS contains all the information required by the CPR.*

**CEPA information:** All ingredients are listed on the DSL.

**TSCA information:** All ingredients are listed on the TSCA inventory.

**HMIS Rating:** Health: 0  
Flammability: 1  
Reactivity: 0

**SECTION 16 — OTHER INFORMATION**

**Legend:** ACGIH: American Conference of Governmental Industrial Hygienists  
CAS: Chemical Abstract Services  
CEPA: Canadian Environmental Protection Act  
DSL: Domestic Substances List  
HMIS: Hazardous Materials Identification System  
HSDB: Hazardous Substances Data Bank  
IARC: International Agency for Research on Cancer  
N/Ap: not applicable  
N/Av: not available  
NIOSH: National Institute of Occupational Safety and Health  
OSHA: Occupational Safety & Health Administration  
PEL: Permissible Exposure Limit  
PSI: Pounds per Square Inch  
RTECS: Registry of Toxic Effects of Chemical Substances  
TSCA: Toxic Substances Control Act  
TLV: Threshold Limit Values  
WHMIS: Workplace Hazardous Materials Information System

**References:**

1. ACGIH, Threshold Limit Values and Biological Exposure Indices for 2006.
2. International Agency for Research on Cancer Monographs, searched 2007.
3. Canadian Centre for Occupational Health and Safety, CCIInfoWeb databases, 2007 (Chempendium, HSDB and RTECs).
4. Previous version of the Material Safety Data Sheet, dated November 19, 2003.

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