ELECTRONIC SPACE PRODUCTS INTERNATIONAL

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name: Hafnium
Formula: Hf
Chemical Family: Group 4 Metal
CAS#: 7440-58-6

II HAZARDOUS INGREDIENTS

Hazardous Component	%	OSHA/PEL	ACGIH/TLV
Hafnium	97-99.8	0.5 mg/m^3	0.5 mg/m^3
Zirconium	0.05-3	5 mg/m^3	10 mg/m^3

HMIS Hazard Rating (Solid): **Health**: 0 **Flammability**: 0 **Reactivity**: 0
HMIS Hazard Rating (Powder): **Health**: 2 **Flammability**: 3 **Reactivity**: 0

III PHYSICAL DATA

Boiling Point: 4600 ºC
Freezing/Melting Point: 2227 +20 ºC
Vapor Density: N/A
Vapor Pressure: 0 @ 20 ºC
Specific Gravity: 13.3 g/cc at 20 ºC
% Volatile: Nonvolatile
Appearance and Odor: Silver metallic solid or gray powder, no odor.
Solubility in H_2O: Insoluble

IV FIRE AND EXPLOSION HAZARDS DATA

Flash Point: N/A
Explosive Limits: **Lower**: N/A **Upper**: N/A

Ignition Point: Solid hafnium will not ignite. 10 micron powder may autoignite at room temperature.
Extinguishing Media: Use suitable media for metal fires, such as type D extinguisher or dry salt. DO NOT USE WATER.
Fire Fighting Procedures: Isolate burning material. It is advisable to allow large fires to burn out, keeping the fire from spreading. 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 & Explosion Hazard: **Do not spray water on burning fines, chips, powder or sponge as a violent explosion may result**. This hazard increases with finer particles. If a fire starts in a mass of wet metal fines, such as a barrel of damp machining chips, the initial fire may be followed by an explosion and a very high temperature flash

radiation. Therefore, when in doubt, personnel should retire and not attempt to extinguish the fire. The explosion characteristics of such material is caused by the hydrogen and steam generated by the burning mass. Carbon dioxide is not effective in extinguishing burning hafnium. Powder may explode when heated with nitrogen, phosphorus, oxygen, sulfur, non-metals, oxidizing agents or halogens. May explode on contact with hot nitric acid and other oxidants.

V HEALTH HAZARD INFORMATION

Effects of Exposure:

To the best of our knowledge the chemical, physical and toxicological properties of hafnium metal have not been thoroughly investigated and recorded. Hafnium is a poison by unspecified route. It is poorly soluble in water and thus is not absorbed efficiently by ingestion. Many hafnium compounds are poisons. (Sax, Dangerous Properties of Industrial Materials, eighth edition)

Acute Effects:

Inhalation: Toxic by inhalation. May cause irritation to the nose, throat and mucous membranes.
Ingestion: Considered to be non-toxic due to poor absorption in the alimentary tract of mammals.
Skin: May cause irritation.
Eye: May cause irritation.

Chronic Effects: May cause damage to the liver. No other chronic effects are recorded.

Routes of Entry: Inhalation, skin , eye

Target Organs: May affect the liver.
Medical Conditions Generally Aggravated by Exposure: Pre-existing respiratory disorders.
Carcinogenicity: **NTP**: No **IARC**: No **OSHA**: No

EMERGENCY AND FIRST AID PROCEDURES:

INHALATION: Remove victim to fresh air; keep warm and quiet; give oxygen if breathing is difficult and seed medical attention.
INGESTION: N/A, poorly absorbed by ingestion.
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.

VI REACTIVITY DATA

Stability: Stable
Conditions to Avoid: None
Incompatibility (Material to Avoid): Hafnium metal is rapidly dissolved by hydrofluoric acid or hydrofluoric-nitric acid mixtures. Above 200 ^{o}C, hafnium reacts exothermically with fluorine, chlorine, bromine, iodine and with halocarbons, including carbon tetrachloride, carbon tetrafluoride and Freons. Nitryl fluoride, FNO_2, will initiate a reaction with hafnium metal at room temperature to produce a glowing or white incandescence. Chlorates, chromates, nitrates, sulfates, molybdates, tungstate, borax, lead oxide and copper oxide.

Hazardous Decomposition Products: Hafnium metal does not decompose. The above reactions with incompatible materials will generate hazardous reaction products such as flammable hydrogen, toxic fumes of nitrogen oxides or corrosive hafnium halide vapors

Hazardous Polymerization: Will not occur

VII SPILL OR LEAK PROCEDURES

Steps to be Taken in Case Material is Released or Spilled: For powder spills, wear appropriate respiratory and protective equipment specified in section VIII. Isolate spill area, provide ventilation and extinguish sources of ignition. 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. Use non-sparking tools.

Waste Disposal Method: Dispose of in accordance with local, state, and federal regulations.

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection: Wear appropriate NIOSH-approved dust-mist-vapor cartridge respirator while conducting operations such as surface grinding which will generate respirable dust.
Ventilation: Powder: Handle in an inert has such as argon, in a controlled atmosphere. Use local exhaust to maintain concentration at or below the PEL, TLV.

Protective Gloves: Rubber gloves
Eye Protection: Wear goggles or face mask while conducting operations such as surface grinding which will generate flying particles.

Protective Clothing: Protective gear suitable to prevent contamination.
Additional Protective Measures: Wear reflective heat resistant suit while burning fine scrap.

IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storage: Store in a cool, dry area. Store in tightly sealed container. Wash thoroughly after handling. Machining of hafnium may result in fine turnings, chips or dust. Any material with a dimension less than 0.0625 inch (1/16 in.) or a cross section less than 0.0078 in^2 (1/16 x 1/8), if present in any quantity, can be ignited and can sustain combustion. Keep away from any source of ignition. 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%.**

Other Precautions: Do not accumulate large quantities of fines or machining residues. Dispose of these materials daily.

FIRE DANGER: **FINE CHIPS, TURNINGS, OR GRINDING DUST PRODUCED FROM THIS METAL ARE FLAMMABLE**.

Work 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. Maintain safety drench shower, eyewash capable of sustained flushing, and facilities for washing.

Transportation Requirements: Department of Transportation Requirements: Not hazardous by D.O.T. Regulations.

The above information is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI shall not be held liable for any damage resulting from handling or from contact with the above product.

Issued by: S. Dierks
Date: February 2003