ELECTRONIC SPACE PRODUCTS INTERNATIONAL

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MATERIAL SAFETY DATA SHEET

I PRODUCT IDENTIFICATION

Trade Name: Hafnium
Synonyms: Crystal Bar Hafnium, Iodide Bar Hafnium
CAS#: 7440-58-6
Chemical Family: Group 4 Metal
Formula: Hf

II HAZARDOUS INGREDIENTS

Hazardous Components	%	OSHA/TWA	OSHA/STEL
Hafnium	97-99.8	0.5 mg/m^3	N/A
Zirconium	0.05-3	5 mg/m^3	10 mg/m^3

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

III PHYSICAL DATA

Boiling Point 760 mm Hg: 4600 °C
pH of Solutions: N/A
Bulk Density: 830 lb/ft^3 (solid)
Vapor Pressure: 0 @ 20 °C
Heat of Solutions: N/A
Appearance and Odor: Similar to Stainless steel.
Vapor Density(Air=L): N/A
Freezing/Melting Point: 2227 +20 °C
% Volatile by Volume: Nonvolatile
Evaporation Rate: None
Specific Gravity (H_2O=L): 13.3
Solubility (Weight in H_2O): Insoluble

IV FIRE AND EXPLOSION HAZARDS DATA

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

Fire Danger: **Fine chips, turnings, or grinding dust produced from this metal are flammable**.

Ignition Point: Solid hafnium will not ignite. 10 micron powder may autoignite at room temperature.

Extinguishing Media: Type D Fire Extinguisher. Dry table salt.
Fire Fighting Procedures: Isolate burning material. It is advisable to allow large fires to burn out, keeping the fire from spreading. Wear reflective heat resistant suit. Small fires can be controlled by smothering with dry salt or using Type D dry-powder fire extinguishing material.

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.

V HEALTH HAZARD INFORMATION

Routes of Entry: **Inhalation**: No **Ingestion**: No **Skin absorption**: No **Skin/Eye Contact**: No

Target Organs: None known
Toxicity Data: Hafnium metal has no known toxicity. The metal is completely insoluble in water, saline solutions or body chemicals. See comments below for soluble hafnium compounds.

Corrosive: No **Carcinogen**: No **Sensitizer**: No
Comments: Soluble hafnium compounds have been reported to cause liver damage in lab tests on animals. The LD50 of hafnium, chiefly as the oxychloride, was 76 mg/kg for mice. A 90 day hafnium chloride feeding study in rats at 1.0% and 0.1% resulted in unspecified liver effects. No industrial disease has been evident with up to 20 years exposed to hafnium compounds.

Acute Effects from Exposure: None known
Chronic Effects from Exposure: None known

References: NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards Casarett and Doull's Toxicology, 2nd Edition OSHA 20CFR 1910 Table Z-1-A, Jan. 1989.

EMERGENCY AND FIRST AID PROCEDURES:

EYE: Normal procedure for inert foreign object.
SKIN: Normal procedure for cuts from sharp metal.
INHALATION: N/A
INGESTION: N/A

VI REACTIVITY DATA

Stability: Stable
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.

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: No special procedures.
Waste Disposal Method: Fine non-recyclable scrap should be burned in small quantities under controlled conditions. Resultant hafnium oxide can be deposited in a landfill.

Environmental Hazards: None

VIII SPECIAL PROTECTION INFORMATION

Respiratory Protection: Wear appropriate NIOSH-approved respirator while conducting operations such as surface grinding which will generate respirable dust.

Protective Clothing: Use gloves to avoid cuts.
Eye Protection: Wear goggles or face mask while conducting operations such as surface grinding which will generate flying particles.

Additional Protective Measures: Wear reflective heat resistant suit while burning fine scrap.

IX SPECIAL PRECAUTIONS

Precautions to be Taken in Handling and Storage: 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.

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
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