SAFETY DATA SHEET

ZIRCONIUM POWDER, WET

C.A.S. Number: 7440-67-7

SECTION 1 – IDENTIFICATION

Product/Material:		**MIL-Z-399**
Product Name:		Zirconium Powder, Wet
Synonym:		Zirconium Powder, Aqueous
Chemical Family:		Element
Chemical Formula:		Zr
CAS Number:		7440-67-7
Supplier's Details: **Address:**		Atlantic Equipment Engineers, Inc. 24 Industrial Avenue, P.O. Box 181 Upper Saddle River, NJ 07458
Telephone/Fax Numbers:		(201) 828-9400 / (201) 387-0291
Emergency Contact:	**CHEMTREC**	(800) 424-9300 (703) 527-3887 (Outside the USA)
Product Uses:		Getter technology, pyrotechnics

SECTION 2 – HAZARDS IDENTIFICATION

GHS Classification

Health:	None
Environmental:	None
Physical:	Self-Heating – Category 1 Combustible Dust

GHS Label Elements

Pictogram(s):



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Signal Word: Danger!

Hazard Statements

H251: Self-heating: may catch fire.

OSHA003: May form combustible dust concentrations in air.

Precautionary Statements

Prevention:

P235+P410: Keep cool. Protect from sunlight.

P280: Wear protective glove, protective clothing and eye protection.

Storage:

P407: Maintain air gap between stacks/pallets.

P420: Store away from other materials.

Disposal:

P501: Dispose of contents and containers in accordance with local, regional and national regulations.

Supplemental Hazard Information: Dry powder may readily ignite when in contact with air. Do not allow to dry. In case of fire, use extinguishing media on basis of sodium chloride, dry chemical, or limestone powder. Never use water, foam or halons.

SECTION 3 – COMPOSITION

Component	CAS No.	Weight %
Zirconium	7440-67-7	< 70%
Hafnium	7440-58-6	0.2 – 2.8%
Water	7732-18-5	> 27%

SECTION 4 – FIRST-AID MEASURES

Rescuers should not attempt to retrieve victims of exposure to this product without adequate personal protective equipment or by themselves.

WARNING: Decontamination should be done with copious amounts of water to flush off all contamination as quickly as possible.

Rescuers must wear appropriate personal protective equipment. Victims of chemical exposure must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take copy of label and SDS to physician or health professional with victim.

Skin Exposure: Brush off as much of the solid product as possible and then immediately begin decontamination with very large volumes of water. Minimum flushing time is 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victims must seek immediate medical attention if any adverse effect occurs.

Eye Exposure: If this product contaminates the eyes, open victim's eyes while under gently running water. Use sufficient force to open eyelids. Have victim "roll" eyes. Minimum flushing

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is for 15 minutes. Victims must seek immediate medical attention if any adverse effect occurs.

Inhalation: If this product is inhaled, remove victim to fresh air. If necessary, use artificial respiration to support vital functions. Remove or cover gross contamination to avoid exposure to rescuers. Victims must seek immediate medical attention if any adverse effect occurs.

Ingestion: If this product is swallowed, call physician or poison control center for most current information. Do not induce vomiting. Never induce vomiting or give diluents (milk or water) to someone who is unconscious, having convulsions, or unable to swallow.

Most Important Symptoms/ Effects, Acute and Delayed: Irritation of eyes and skin. Inhalation of dust or mists may cause respiratory irritation.

Indication of Immediate Medical Treatment and Special Treatment: Immediate medical treatment is generally not required.

SECTION 5 – FIRE-FIGHTING MEASURES

Fire Extinguishing Media: **DO NOT USE WATER, CARBON DIOXIDE OR HALOGENATED AGENTS.** Use class D extinguisher, dry chemical, dolomite (powdered limestone), dry sodium chloride.

Specific Fire / Explosion Hazards: Zirconium powder fires burn very hot and are difficult to extinguish. Fire may reignite after being extinguished. Large amounts of water will prevent ignition of zirconium but once ignited, zirconium will burn under water. When mixed with at least 25% water, flammability is reduced. Slightly damp powder (2-10% water) can ignite and burn instantaneously and explosively. Blend powder with a large excess of extinguishing media. Product can easily ignite in dry air. Sensitive to shock, heat, friction and static electricity. Combustion in air is stimulated by the presence of small amounts of water. Burning zirconium decomposes water instantaneously. Dust may form explosive mixture with air.

Explosion Sensitivity to Mechanical Impact: Sensitive.

Explosion Sensitivity to Static Discharge: Very sensitive.

Special Fire-Fighting Equipment and Procedures: Firefighters and all others who may be exposed to the products of combustion should be equipped with positive pressure self-contained breathing apparatus and fire resistant protective clothing. For additional information, refer to NFPA 484 Standard for Combustible Metals, Metal Powders, and Metal Dusts, most recent edition. For additional information, refer to OSHA Publication 3644 “Firefighting Precautions at Facilities with Combustible Dust”.

SECTION 6 – ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: Uncontrolled releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a spill, clear the affected area and protect people. Eliminate all sources of ignition and use only non-sparking tools. The minimum Personal Protective Equipment recommended for response to non-incidental/non-fire releases should be **Level B: gloves, chemical resistant suit and boots, hard-hat, and Self Contained Breathing Apparatus.**

Methods and Materials for

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Containment/Cleanup: Wet powder with a large amount of water and collect. Place all spill residue in an appropriate container. Half dry powder (2-10% water) can ignite and burn, throwing off sparks. When dry there is a dust explosion hazard. Dust deposits should not be allowed to accumulate on surfaces, as these may form an explosive mixture if they are released into the atmosphere in sufficient concentration. Avoid dispersal in the air (i.e., clearing dust surfaces with compressed air). Dispose of in accordance with U.S. Federal, State, and local or Canadian solid waste disposal regulations (see Section 13, Disposal Considerations).

SECTION 7 – HANDLING AND STORAGE

Precautions for Safe Handling: Avoid getting this product ON YOU or IN YOU. Wash thoroughly after handling. Avoid creating and breathing airborne dusts. Do not eat or drink while handling. All employees who handle this product should be trained to handle it safely. Employees should be trained on the information in the SDS before working with this product. Keep product away from sparks, flames, and other ignition sources. Post "No Smoking" signs in the area of use. Do not allow to dry. Ensure containers are properly labeled. Keep containers closed when not in use. Ground all equipment, tables, etc. Minimize dust generation and accumulation. Routine housekeeping should be instituted to ensure that dusts do not accumulate on surfaces. Dry powders can build static electricity charges when subjected to the friction of transfer and mixing operations. Provide adequate precautions, such as electrical grounding and bonding, or inert atmospheres. Use only appropriately classified electrical equipment and powered industrial trucks.

For additional information, refer to NFPA 654 Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids, most recent Editions.

Storage: Do not allow to dry. Store containers in a cool, dry location, away from direct sunlight or sources of intense heat. Store away from incompatible materials (see Section 10, Stability and Reactivity. A detached, fire-resistant building is recommended for storing large quantities. Inspect stored container periodically for possible leakage or build-up of pressure by slow hydrogen generation. Use only non-sparking tools and utensils. Avoid heat, friction, sparks and flames. Empty containers may contain residual material; therefore, empty containers must be handled with care.

For additional information, refer to NFPA 484 Standard for Combustible Metals, Metal Powders, and Metal Dusts most recent Edition. Local Fire Departments should be notified of the storage of Zirconium Metal Powder on site. Storage and processing areas should be identified with a NFPA 704 placard (diamond) large enough to be seen from a distance.

SECTION 8 – EXPOSURE CONTROLS/PERSONAL PROTECTION

Component	Exposure Limits in Air				
	ACGIH-TLVs		OSHA-PELs		OTHER
	TWA mg/m^3	STEL mg/m^3	TWA mg/m^3	STEL mg/m^3	mg/m^3
Zirconium	5	10	5	NE	NE
Hafnium	0.5	NE	0.5	NE	NIOSH REL: 0.5
NE = Not Established See Section 16 for Definition of other terms and acronyms used.					

The information presented is based only on this product. The Exposure Controls and Personal Protection required will be dependent on the conditions present in the workplace, including the presence of other chemicals. PPE should be based on a Hazard Assessment as required in 29CFR1910.132.

Ventilation and Engineering

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Controls:

Use with adequate ventilation. Mechanical exhaust may be needed. Explosion-proof equipment should be used where required. Special controls may be needed due to fire hazard.

It is recommended that all dust control equipment such as local exhaust ventilation and material transport systems involved in handling this product as a powder or in processes where dust may be generated contain explosion relief vents or an explosion suppression system or an oxygen deficient environment. Ensure that dust collection systems (such as exhaust ducts, dust collectors, vessels, and processing equipment) are designed in a manner to prevent the escape of dust into the work area (i.e., there is no leakage from the equipment). Use only appropriately classified electrical equipment and powered industrial trucks. For additional information, refer to NFPA 484: Standard for Combustible Metals, Metal Powders, and Metal Dusts, most recent Edition.

Respiratory Protection:

If workers are directly exposed to powder, the use of respiratory protection should be considered. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

Eye Protection:

Chemical goggles are recommended. If necessary, refer to U.S. OSHA 29 CFR 1910.133, and appropriate Canadian Standards.

Hand Protection:

Fire retardant gloves recommended. Gloves should be worn in a way that they may be quickly removed in the event they become contaminated with material that ignites. If necessary, refer to U.S. OSHA 29 CFR 1910.138 and appropriate Standards of Canada.

Body Protection:

Use body protection appropriate for task taking the flammability and reactivity of the product into consideration. In most cases, protection from the potential fire hazard is of greater concern than the need for chemically impervious clothing. Chemical resistant clothing may not be fire retardant and might char or burn in contact with this product. If chemical resistant clothing is needed, fire retardant garments should be worn over the chemical resistant clothes.

Emergency Eye-Wash/ Safety Showers:

Where there is any possibility that an employee may be exposed to this substance, the employer should provide an eye-wash fountain/safety shower within the immediate work area for emergency use. **Location of the eye-wash fountain/ safety shower must be selected to avoid contact of water with this material.**

SECTION 9 – PHYSICAL AND CHEMICAL PROPERTIES

Appearance:	Dark gray suspension
Dust Explosivity:	Combustible dust when dry
Odor:	None
Odor Threshold:	Not applicable
pH:	Not applicable
Melting/Freezing Point:	1852 ºC (3366 ºF)
Boiling Point:	3577 ºC (6471 ºF)
Flash Point:	Not applicable
Evaporation Rate:	Not applicable

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Flammability:	Self-heating solid
Viscosity:	Not applicable
Flammable Limits (in Air by Volume):	Not applicable
Vapor Pressure, mm Hg @ 20°C:	Not applicable
Vapor Density (Air = 1):	Not applicable
Specific Gravity (Water = 1):	6.5
Solubility in Water @ 20 ºC:	Insoluble, Water reactive
Coefficient of Oil / Water Distribution (Partition Coefficient):	Not established
Autoignition Temperature:	170-250 ºC (338-482 ºF)
Decomposition Temperature:	Not established

SECTION 10 – STABILITY AND REACTIVITY

Reactivity: Burning zirconium decomposes water instantaneously (explosion).

Stability: The main hazard source when manipulating zirconium powder is its very high flammability, even by electric charges. When mixed with at least 25 weight-percent water, its flammability is significantly reduced. On the other hand, slightly humid, half-dry zirconium powder (2-10% water) can ignite and burns then instantaneously (explosion), throwing off sparks. When dry, there is a dust explosion hazard. Self-heating: may catch fire.

Possibility of Hazardous Reactions: Mixture reacts slowly with water resulting in evolution of hydrogen. Very highly flammable and self-igniting under unfavorable conditions, burns white hot with formation of zirconium oxide and zirconium nitride. When mixed with oxidizing substances explosion hazard. Burning zirconium decomposes water with formation of oxyhydrogen gas. Self-heating: may catch fire. Dust may be explosive in air.

Conditions To Avoid: Exposure to sunlight, heat, flames and other sources of ignition and incompatible chemicals. Take precautionary measures against static discharge. Do not allow to dry.

Incompatible Materials: Halogens, hydrogen fluoride, oxidizing agents.

Hazardous Decomposition Products: Decomposes slowly in contact with water forming hydrogen.

SECTION 11 – TOXICOLOGICAL INFORMATION

Symptoms of Overexposure by Route of Exposure: In terms of anticipated occupational overexposure situations for employees, the main health effect from overexposure would be irritation skin and eyes that have been contaminated with Zirconium Powder.

Inhalation: Inhalation of dust or fumes may cause mucous membrane and respiratory tract irritation.

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Contact with Skin or Eyes: May cause mild to moderate irritation. Particles of zirconium embedded in the skin may cause granulomas (skin nodules).

Skin Absorption: Skin absorption is not a significant route of exposure for zirconium.

Ingestion: Ingestion is not anticipated to be a significant route of occupational exposure. Swallowing may cause mouth, throat and gastrointestinal irritation. Zirconium is not expected to be acutely toxic by ingestion.

Chronic: Prolonged inhalation to zirconium dust or fumes may cause pulmonary granulomas.

Target Organs

Acute: Eyes, skin, mucous membranes.

Chronic: Lung.

Toxicity Data: There are no toxicology data currently available for Zirconium or Hafnium.

Carcinogenicity Status: Zirconium and Hafnium are not listed as carcinogens or suspected carcinogens by IARC, NTP, OSHA or ACGIH.

Irritancy of Product: This product is expected to irritate the skin and eyes.

Sensitization to the Product: No component of this product is known to be a sensitizer.

REPRODUCTIVE TOXICITY INFORMATION

Mutagenicity: No data is available to evaluate the potential mutagenicity of this product.

Embryo-Toxicity: No data is available to evaluate the potential embryo-toxicity of this product.

Teratogenicity: No data is available to evaluate the potential teratogenicity of this product.

Reproductive Toxicity: No data is available to evaluate the potential reproductive toxicity of this product.

SECTION 12 – ECOLOGICAL INFORMATION

All work practices must be aimed at eliminating environmental contamination.

Acute Aquatic Toxicity: No specific data are available

Degradability: No data currently available.

Log Bio-Concentration Factor (BCF): No data currently available.

Log Octanol/Water Partition Coefficient: No data currently available.

SECTION 13 – DISPOSAL CONSIDERATIONS

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Preparing Wastes for Disposal: Waste disposal must be in accordance with appropriate U.S. federal, state, and local regulations or with regulations of Canada and its Provinces.

SECTION 14 – TRANSPORT INFORMATION

UN Identification Number: UN 1358

Proper Shipping Name: Zirconium Powder, wetted

Hazard Class Number and Description: 4.1 (Flammable Solid)

Packing Group: PG II

DOT Label(s) Required: 4.1 (Flammable Solid)

North American Emergency Response Guidebook Number (2016): 170

Marine Pollutant: Not applicable (per 49 CFR 172.101, Appendix B).

Transport Canada Transportation of Dangerous Goods Regulations

This material is considered as Dangerous Goods, per regulations of Transport Canada. The use of the above U.S. DOT information from the U.S. 49 CFR regulations is allowed for shipments that originate in the U.S. For shipments via ground vehicle or rail that originate in Canada, the following information is applicable:

UN Identification Number: UN 1358

Proper Shipping Name: Zirconium Powder, wetted

Hazard Class Number and Description: 4.1 (Flammable Solid)

Hazard Label(s) Required: 4.1 (Flammable Solid)

Packing Group: II

Special Provisions: None

Explosive Limit and Limited Quantity Index: 1

ERAP Index: None

Passenger Carrying Ship Index: Forbidden

Passenger Carrying Road or Rail Vehicle Index: 15

Marine Pollutant: No component of this product is listed as a marine pollutant under TC regulations.

Emergency Response Contact for an Incident during Transportation: CHEMTREC 1-800-424-9300 or 1-703-527-3887 (outside the United States)

SECTION 15 – REGULATORY INFORMATION

Additional U.S. Regulations

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U.S. Sara Reporting Requirements: The components of this product are not subject to the reporting requirements of the Comprehensive Environmental Response, Compensation, and Liability Act and Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

CERCLA Section 103 (40 CFR 302.4): No

SARA Section 302 (40 CFR 355.30): No

SARA Section 304 (40 CFR 355.40): No

SARA Section 313 (40 CFR 372.65): No

U.S. SARA Section 311/312 Hazard Categories: Fire hazard

U.S. SARA Threshold Planning Quantity: There are no specific Threshold Planning Quantities for Sodium Tert-Butoxide. The default federal SDS submission and inventory requirement filing threshold of 10,000 lb. (4,540 kg) may apply, per 40 CFR 370.20.

U.S. CERCLA Reportable Quantity (RQ): Not applicable.

U.S. TSCA Inventory Status: The components of this product are listed on the TSCA Inventory.

U.S. TSCA 12(b) Export Notification: TSCA 12(b) Notification is not required, per 40 CFR 707, for the components of this product.

U.S. State Regulatory Information

Components are covered under specific State regulations, as denoted below:

Massachusetts - Substance List: Zirconium, Hafnium

Michigan - Critical Materials Register: None

New Jersey - Right to Know Hazardous Substance List: Zirconium, Hafnium

Pennsylvania - Hazardous Substance List: Zirconium, Hafnium

California Safe Drinking Water and Toxic Enforcement Act (Proposition 65): The components are not on the California Proposition 65 lists.

Additional Canadian Regulations

Canadian DSL/NDSL Status: The components of this product are on the DSL Inventory.

Canadian WHMIS Symbols: Class B4 (Flammable Solid)

This SDS has been prepared according to the criteria of the Controlled Products Regulation (CPR) and the SDS contains all of the information required by the CPR.

SECTION 16 – OTHER INFORMATION

Hazardous Material Identification System Rating (HMIS)

Health Hazard: 1

Fire Hazard: 3

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Physical Hazard: 0

NFPA 704 Rating

Health Hazard: 1

Fire Hazard: 3

Instability Hazard: 0

Special: ~~W~~

4 = Severe Hazard 3 = Serious Hazard 2 = Moderate Hazard 1 = Slight Hazard 0 = Minimal Hazard

Note: The current NFPA 704 ratings use Instability rather than Reactivity. The ratings for Instability do not include water reactivity as a criteria. Materials that react violently with water are identified by the symbol ~~W~~.

Definitions of Exposure Limit Terms and Abbreviations

ACGIH: American Conference of Governmental Industrial Hygienists, a professional association that establishes exposure limits.

TLV: Threshold Limit Value, an airborne concentration of a substance that represents conditions under which it is generally believed that nearly all workers may be repeatedly exposed without adverse effect. The duration must be considered, including the 8-hour Time Weighted Average (TWA), the 15-minute Short Term Exposure Limit, and the instantaneous Ceiling Level (C). Skin absorption effects must also be considered.

OSHA: U.S. Occupational Safety and Health Administration.

PEL: Permissible Exposure Limit - This exposure value means exactly the same as a TLV, except that it is enforceable by OSHA. The OSHA Permissible Exposure Limits are based on the 1989 PELs and the June, 1993 Air Contaminants Rule (Federal Register: 58: 35338-35351 and 58: 40191). Both the current PELs and the vacated PELs are indicated. The phrase, "Vacated 1989 PEL," is placed next to the PEL which was vacated by Court Order.

IDLH: Immediately Dangerous to Life and Health - This level represents a concentration from which one can escape within 30-minutes without suffering escape-preventing or permanent injury. The DFG MAK is the Republic of Germany's Maximum Exposure Level, similar to the U.S. PEL.

NIOSH: The National Institute of Occupational Safety and Health, which is the research arm of the U.S. Occupational Safety and Health Administration (OSHA). NIOSH issues exposure guidelines called Recommended Exposure Levels (RELs). When no exposure guidelines are established, an entry of NE is made for reference.

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