



MATERIAL SAFETY DATA SHEET

WAH CHANG

PO BOX 460 - ALBANY, OREGON - 97321

SECTION 1.

Revised: 5/10/2011

Product Number: 332-1

PRODUCT: ZIRCONIUM & ZIRCONIUM BASE ALLOYS (SOLIDS)

SYNONYMS: This MSDS covers zirconium alloys containing small percentages of alloy elements, including the following alloys and/or Wah Chang trademark products: Zircaloy-2, Zircaloy-4, Zr-2.5Nb, ZrNb705, Zircadyne 704, Zircadyne 705, Zircadyne 706, ASTM Grades B350-R60802, B350-B60804, B350-B60901, B352-R60812, B352-R60814, B493-R60704, B493-R60705, B493-R60706, B60801, B493-R60702, and Zircadyne 702.

CHEMICAL FAMILY: Zirconium & Zirconium Metal Alloy

HMIS HAZARD RATING: HEALTH = 0 FIRE = 0 REACTIVITY = 0

HMIS RATING: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe * = Chronic

24 HOUR EMERGENCY ASSISTANCE

WAH CHANG

An Allegheny Technologies Company

541-926-4211

CHEMTREC
800-424-9300

FIRE DANGER: Fine chips, turnings, or dust produced from these metals are highly flammable and may represent an explosion hazard. Do NOT apply water in attempt to extinguish a zirconium fire.

SECTION 2. HAZARDS IDENTIFICATION

Occupational Exposure Limits:

See SECTION 3. below

ROUTES OF ENTRY

INHALATION: Yes (dust)

INGESTION: No

SKIN ABSORPTION: No

SKIN/EYE CONTACT: Yes (dust)

SECTION 3. COMPOSITION, INGREDIENTS INFORMATION

CHEMICAL COMPONENTS	%	C.A.S. NO.	OR-OSHA/ACGIH EXPOSURE LIMITS mg/m ³ or ppm	
			PEL	TLV
Zirconium, Zr	90-99.7	7440-67-7	5	5
Hafnium, Hf	.005-10	7440-58-6	0.5	0.5
Niobium, Nb	0-4	7440-03-1	10 (PNOR)	10 (PNOS)
Tin, Sn	0-3	7440-31-5	2	2
Molybdenum, Mo	0-2	7439-98-7	10 (insoluble)	10 (insoluble)
Iron, Fe	0-1	7439-89-6	10 (PNOR)	10 (PNOS)
Chromium, Cr	0-1	7440-47-3	1	0.5 (as metal)
Nickel, Ni	0-0.1	7440-02-0	1	1.5 (elemental)
Copper, Cu	0-0.1	7440-50-8	1 (dust), 0.1 (fume)	1 (dust), 0.2 (fume)
Silicon, Si	<0.05	7440-21-3	10 Total, 5 Respirable	10 Total, 3 Respirable

PNOR = Particles Not Otherwise Regulated, PNOS = Particles Not Otherwise Specified

SECTION 4. FIRST AID MEASURES

INHALATION:	Remove to fresh air
EYE CONTACT:	Follow the normal procedure for removal of a foreign object and obtain medical attention as needed.
SKIN CONTACT:	Follow the normal procedure for cuts or abrasions.
INGESTION:	Not Applicable

SECTION 5. FIRE FIGHTING MEASURES

IGNITION POINT:	Although the solid metal will not ignite, high surface area material such as 10 micron powder or fine turnings may spontaneously ignite at room temperature.
MINIMUM EXPLOSION CONCENTRATION (g/m ³):	Not Available for alloys, 40 for Zr
EXTINGUISHING MEDIA:	Dry table salt or Type D fire extinguisher
FIRE FIGHTING PROCEDURES:	If metal fines ignite, allow the material to burn out. Control small fires by smothering with dry table salt or using a Type D fire extinguisher. Separate burning material from larger mass, and allow it to burn out.
UNUSUAL FIRE AND EXPLOSION HAZARDS:	Do not spray water on burning zirconium. Carbon dioxide is not effective in extinguishing burning zirconium either. If a fire starts in a mass of wet metal fines, an explosion may follow due to rapidly expanding gases. The explosive characteristic of such material is caused by the steam and hydrogen generated within the burning mass.

SECTION 6. ACCIDENTAL RELEASE MEASURES

SPILL OR LEAK PROCEDURES:	Sweep up spilled solids. Keep finely divided zirconium away from any source of ignition and cleaned up immediately. Follow the Emergency Response Guidebook No. 170 as appropriate for spill response.
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SECTION 7. HANDLING AND STORAGE**PRECAUTIONS TO TAKE DURING HANDLING AND STORAGE:**

Machining of zirconium may result in fine turnings or chips. Any quantity of material with a dimension less than 0.0625-inch (1/16 in.) or a cross section less than 0.0078-inch square (1/16 x 1/8), may spontaneously ignite. Keep all finely divided material away from any source of ignition. **Warning:** May form Combustible (Explosive) Dust - Air mixtures. Keep away from all ignition sources including heat, sparks, and flame. Keep container closed and grounded. Prevent dust accumulations to minimize explosion hazard.

Store fine turnings completely dry or very wet. If stored wet, maintain water content more than 25% by weight. Severe explosions can result from ignition of zirconium powder or machine fines containing moisture in the concentration of 5 to 10%.

OTHER PRECAUTIONS:

Accumulation of very finely divided scrap or sawdust with a dimension less than 0.012 inches is pyrophoric (may burn rapidly). Dispose of this material in small amounts in sealed in plastic bags.

When the chemical corrosion resistance of zirconium is exceeded, a product containing fine zirconium particulate can form on the surface, which is easily ignited. By heating the material to 250°C for 1 hour or 100°C for 7 days, this film becomes non-flammable by oxidation. Ref: 1) Yau, T-L., "Methods to Treat Pyrophoric Film on Zirconium" Industrial Applications of Titanium and Zirconium: Third Conference. ASTM STP 830, 1984, pp 124-129. 2) Materials Technology Institute, Publication No. 19, "Pyrophoric Surfaces on Zirconium Equipment - A potential Ignition Hazard", C.P. Dillon, Columbus, Ohio

SECTION 8. EXPOSURE CONTROL, PERSONAL PROTECTION

RESPIRATORY PROTECTION: Wear a NIOSH approved respirator consistent with a Personal Protective Equipment (PPE) Assessment of the task involving the material.

PROTECTIVE CLOTHING: In dusty atmospheres, wear Fire Rated clothing & gloves determined necessary with a PPE Assessment of the task involving the material.

EYE PROTECTION: Wear approved safety glasses or goggles consistent with a PPE Assessment of the task involving the material.

ADDITIONAL PROTECTIVE MEASURES: Not Applicable

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT @ 760 mm Hg:	Above 4380°C
VAPOR DENSITY (AIR = 1):	Not Applicable
SPECIFIC GRAVITY (H₂O = 1):	6.49-6.64
Ph OF SOLUTIONS:	Not Applicable
FREEZING/MELTING POINT:	1850°C ± 20°C
SOLUBILITY (WEIGHT % IN WATER):	Insoluble
BULK DENSITY:	Not Applicable
% VOLATILE BY VOLUME:	Not Available
VAPOR PRESSURE:	Not Available
EVAPORATION RATE:	Not Available
HEAT OF SOLUTION:	Not Available
APPEARANCE AND ODOR:	Not Available

SECTION 10. STABILITY AND REACTIVITY

STABILITY: Stable

HAZARDOUS POLYMERIZATION: Will not occur

CONDITIONS TO AVOID: See Sections 5 and 7 for discussion of Flammable Nature of Machining Fines

INCOMPATIBILITY (Materials to Avoid): Zirconium metal is rapidly dissolved by hydrofluoric acid or hydrofluoric-nitric acid mixtures. Above 200°C, zirconium reacts exothermically with fluorine, chlorine, bromine, iodine, and halocarbons, including carbon tetrachloride, carbon tetrafluoride and Freons™. Nitryl Fluoride, FNO₂, will initiate a reaction with zirconium metal at room temperature to produce a glowing or white incandescence.

HAZARDOUS DECOMPOSITION PRODUCTS: Zirconium 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 zirconium halide fumes.

SECTION 11. TOXICOLOGICAL INFORMATION

TARGET ORGANS: None

TOXICITY DATA: Zirconium metal and its alloys are non-toxic. The alloying elements dissolved in the zirconium matrix do not exist as free metals. However, if the metal is dissolved, vaporized, or otherwise treated to release the alloying agents in a chemically active form, take into consideration the possible carcinogenic properties of chromium (VI) and nickel.

CORROSIVE: No

CARCINOGEN: No (If alloy is dissolved, Yes)

SENSITIZER: No

COMMENTS: Dust is irritating to the eyes & respiratory tract.

ACUTE EFFECTS FROM EXPOSURE: None known

CHRONIC EFFECTS FROM EXPOSURE: None known

REFERENCES: NIOSH/OSHA - Occupational Health Guidelines for Chemical Hazards
 OSHA - 29 CFR, 1910, Table Z-1-A, January 1989
 Patty's Industrial Hygiene and Toxicology, 3rd Ed., Vol. 2A
 ILO - Encyclopedia of Occupational Health and Safety
<http://apps.echa.europa.eu/registered/registered-sub.aspx>

SECTION 12. ECOLOGICAL PROTECTION

ENVIRONMENTAL HAZARDS: None. As a zirconium alloy, this material is non-toxic.

SECTION 13. DISPOSAL CONSIDERATIONS

WASTE DISPOSAL: Comply with Federal, State, and Local requirements for waste disposal. Finely divided non-recyclable scrap may be considered a hazardous flammable solid. Site specific waste determination is recommended.

SECTION 14. TRANSPORTATION REQUIREMENTS

DEPARTMENT OF TRANSPORTATION CLASSIFICATION: See Section 13 above

D.O.T. PROPER SHIPPING NAME

Not Applicable

PACKING GROUP

Not Applicable

LABELS REQUIRED

Not Applicable

D.O.T. I.D. NUMBER

Not Applicable

HAZARD CLASS

Not Applicable

NORTH AMERICAN EMERGENCY RESPONSE GUIDE NUMBER

Not Applicable

SECTION 15. REGULATORY INFORMATION

Section 313 Supplier Notification: This product contains the following chemicals subject to the reporting requirements of Section 313 of the Emergency Planning and Community Right-To-Know Act of 1986 (40 CFR 372): Chromium, Copper and Nickel Compounds

In addition to the ingredients listed in Section 2, this product contains the following chemicals considered by the State of California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65) as causing cancer or reproductive toxicity and for which warnings are now required: None

The Comprehensive Environmental Response, Compensation, and Liability Act of 1990, Sec102 (40 CFR 302) requires that any "release" into the "environment" of these hazardous substances contained in a product in excess of the "reportable quantity" in any 24-hour period must be immediately reported to the National Response Center (800-424-8802). Reporting is not required under certain circumstances such as a federally permitted release or the release of certain metal solid particles with a diameter larger than 100 micrometers: None

The Superfund Amendments and Reauthorization Act of 1986 (40 CFR 355) specifies certain emergency planning and notification requirements if these extremely hazardous substances are present in concentrations of greater than 1% at a facility in amounts greater than the threshold planning quantity: None

If this product is discarded as a waste, it would be identified with the following hazardous waste classification under the Resource Conservation and Recovery Act (40 CFR 261). The act specifies requirements for the management and disposal of hazardous wastes: If discarded this material may be considered a hazardous flammable solid D001. Site specific testing recommended.

Components on Canadian "ingredient Disclosure List": All components listed on the Ingredient Disclosure List

TSCA (Toxic Substances Control Act): Components of this product listed on the TSCA Inventory are: All listed on TSCA Inventory

SECTION 16. OTHER INFORMATION

MSDS Product Number 332-1 combines previous MSDSs for Products 332 and 301

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