



MATERIAL SAFETY DATA SHEET
WAH CHANG
PO BOX 460 - ALBANY, OREGON - 97321

SECTION 1. Revised: 7/20/2006 Product Number: 332

PRODUCT: 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

CHEMICAL FAMILY: 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 grinding dust produced from this metal are highly flammable

SECTION 2. COMPOSITION, INGREDIENTS INFORMATION

CHEMICAL COMPONENTS	%	C.A.S. NO.	OR-OSHA/ACGIH EXPOSURE LIMITS	
			mg/m ³ or ppm*	
			<u>PEL</u>	<u>TLV</u>
Zirconium, Zr	90-98.5	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	0.1-1	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)

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

SECTION 3. HAZARDS IDENTIFICATION

Occupational Exposure Limits: See Section 2

ROUTES OF ENTRY

- INHALATION: No
- INGESTION: No
- SKIN ABSORPTION: No
- SKIN/EYE CONTACT: No

N. Ap. = Not Applicable

N. Av. = Not Available

SECTION 4. FIRST AID MEASURES

INHALATION:	N.Ap.
EYE CONTACT:	Normal procedure for foreign object, e.g. Flush eye with water for 15 minutes. Get medical attention.
SKIN CONTACT:	Normal procedure for cuts or abrasion
INGESTION:	N.Ap.

SECTION 5. FIRE FIGHTING MEASURES

IGNITION POINT:	Solid metal will not ignite. High surface area material such as 10 micron powder may auto ignite at room temperature
MINIMUM EXPLOSIBLE CONCENTRATION (g/m ³):	N.Av.
EXTINGUISHING MEDIA:	Dry table salt. Type D fire extinguisher
FIRE FIGHTING PROCEDURES:	If metal fines are ignited, allow the material to burn out. Control fires by smothering with dry table salt or using a Type D fire extinguisher. See North American Emergency Response Guide No. 170. Separate burning material from larger mass
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.

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. See North American Emergency Response Guide No. 170
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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), can ignite. Keep all finely divided material away from any source of ignition

Keep fine turnings completely dry or very wet. If kept wet, maintain water content of 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). Disposal of this material is suggested in small amounts 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:	N.Ap.
PROTECTIVE CLOTHING:	Wear gloves to avoid cuts as needed
EYE PROTECTION:	Wear approved safety glasses as needed
ADDITIONAL PROTECTIVE MEASURES:	N.Ap.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

BOILING POINT @ 760 mm Hg:	Above 4380°C
VAPOR DENSITY (AIR = 1):	N.Ap.
SPECIFIC GRAVITY (H ₂ O = 1):	6.49-6.64
Ph OF SOLUTIONS:	N.Ap.
FREEZING/MELTING POINT:	1850 + 20°C
SOLUBILITY (WEIGHT % IN WATER):	Insoluble
BULK DENSITY:	N.Av.
% VOLATILE BY VOLUME:	N.Av.
VAPOR PRESSURE:	N.Av.
EVAPORATION RATE:	N.Av.
HEAT OF SOLUTION:	N.Av.
APPEARANCE AND ODOR:	N.Av.

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 vapors

SECTION 11. TOXICOLOGICAL INFORMATION

TARGET ORGANS: None

TOXICITY DATA: As a zirconium alloy, this material is non-toxic: Zirconium metal is non-toxic, so the alloying elements dissolved in the zirconium matrix do not exist as free metals.
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 compounds

CORROSIVE: No

CARCINOGEN: No (If alloy is dissolved, Yes)

SENSITIZER: No

COMMENTS: None

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

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

N.Ap.

PACKING GROUPD.O.T. I.D. NUMBER

N.Ap.

HAZARD CLASSLABELS REQUIREDNORTH AMERICAN EMERGENCY RESPONSE GUIDE NUMBER**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

None

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