

Casting

OVERVIEW

Titanium and zirconium, both highly reactive in their molten state, require a unique mold system with minimal reactivity. Early Pioneering work and guidelines for the rammed graphite production method for producing titanium and zirconium castings was established by the U.S. Bureau of Mines Research Center in Albany, Oregon during the mid-1950s.

In 1957 the Oregon Metallurgical Corporation (Oremet), now referred to as ATI Wah Chang, built the world's first titanium casting foundry; a facility for manufacturing reactive metal castings. The foundry produced the world's largest cast zirconium pump casting for severe-service Chemical Processing Industry (CPI) equipment in 1991, and is still the world leader in rammed-graphite, titanium and zirconium castings.

Table 1. Casting Alloys		
Titanium	Zirconium	Nickel Based Alloys
ASTM B367	ASTM B752	Other materials may be considered for evaluation and or production
Titanium Grade C-2	Zircadyne® 702C Zirconium	
Titanium Grade C-3	Zircadyne® 705C Zirconium	
Titanium Grade C-5		
Titanium Grade Ti-Pd7B		
Titanium Grade Ti-Pd8A		
Titanium Grade C-9		
Titanium Grade 12		
Titanium Grade 28		
Titanium Grade C-38		
Titanium - Niobium		
Titanium - Nickel		
Titanium - Aluminides		

APPLICATIONS

Markets:

- Military/Armor
- Oil & Gas
- Pulp & Paper
- Hydrometallurgical
- Marine
- Petrochemical
- Pollution Control
- US Navy/Marine

MECHANICAL & PHYSICAL PROPERTIES

Titanium is ideally suited for the following environments:

- Wet chlorine gas
- Solutions contacting chlorine
- Hypochlorous acid
- Hypochlorites
- Nitric acid
- Calcium chloride
- Sea water and fresh water

In these destructive environments, titanium will last many times longer than stainless steel. Although the initial outlay is greater, titanium often proves more economical than stainless steel on a life cycle basis.

Zirconium performs especially well in the following environments:

- Hydrochloric acid
- Sulfuric acid
- Caustics
- Organics and organic acids
- Nitric acid
- Acetic acid
- Formic acid

Since most corrosive environments are not covered by simple cases, testing is recommended. ATI Wah Chang maintains a complete test laboratory to assist you in corrosion testing and materials selection. Information can be found at www.corrosionsolutions.com

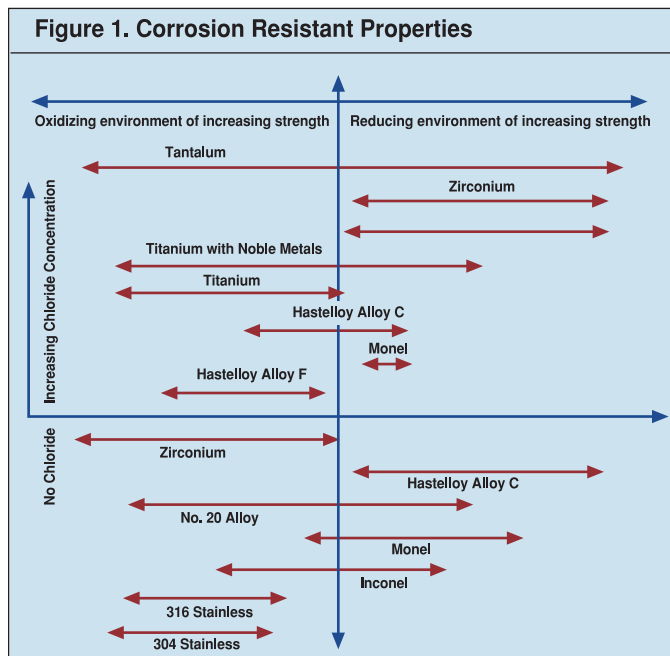
Titanium, zirconium and their alloys are cast centrifugally or statically depending upon shape and size.

SPECIFICATIONS

Table 2. Specifications	
Titanium	
OMC - 105	Rev. K (Addendum A - Commercial/Addendum B - Government)
ASTM B367	Standard Specifications for Titanium and Titanium Alloy Castings
ASME SB367	Standard Specifications for Titanium and Titanium Alloy Castings
Mil	Standards (248/271/278/Navsea)
Norsok MDS - T02	Material data sheets—titanium Grade C2 castings
DIN 17 865	Titanium and titanium alloy investment castings and rammed graphite castings
ASME / ANSI B16.34	Valves—flanged, threaded and welding end
MSS SP - 55	Visual Method for Surface Evaluation of Surface Irregularities
ASTM E8	Test Methods of Tension Testing of Metallic Metals
ASTM E10	Test Methods for Brinell Hardness of Metallic Metals
ASTM E165	Standard Practice for Liquid Penetrant Inspection Method
ASTM E94	Standard Guide for Radiographic Testing
ASME Section IX	Welding and Brazing Qualifications
Zirconium	
OMC 302	Rev. G
ASTM B752	Standard Specification for Zirconium Castings

CORROSION DATA

Both titanium and zirconium are usually resistant to corrosive attack and virtually immune to many oxidizing and reducing environments. This is due primarily to a tenacious oxide film that is formed when titanium and zirconium are exposed to the atmosphere. By combining titanium with small amounts of palladium or molybdenum and nickel, its corrosion resistant properties can be expanded.



MATERIAL SAFETY DATA SHEETS

Material Safety Data Sheets (MSDS) for both titanium and zirconium products produced by ATI Wah Chang are available by contacting Monday – Friday 8 a.m. – 4 p.m. call 541-926-4211 ext. 6458, after hours and on weekends call 541-926-4211 ext. 0. Table 3. lists the reference number by product line.

Table 3. MSDS Reference Numbers	
Product	Reference Number
Titanium Metal	801
Titanium Sponge	802
Titanium Powders, Fines & Dust	803
Titanium Hydride	806
Titanium Base Alloys	833
Zirconium Metal	2834
Zirconium Sponge	2523
Zirconium Powders, Fines & Dust	303
Zirconium Base Alloys	2835

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