

## Special Alloy Fabrication

### ALLOY DEVELOPMENT

Over the last 20 years Wah Chang has played a major role in the development and production of a wide variety of zirconium, niobium, tantalum, vanadium and specialty titanium alloys for the nuclear and aerospace industries. The company's success in this field is often linked to its ability to maintain high levels of alloy purity.

In other cases, Wah Chang's ability to evaluate a wide variety of melting and fabrication process unique to refractory metals has been a key to its successful development of new materials. Over the last ten years, the company's diversifying product lines and customer base have demanded a continual use of all of its alloy development capabilities. Consequently, Wah Chang maintains a team of personnel and associated equipment specifically devoted to developmental melting and fabrication of refractory metals. The company routinely provides these services to aerospace and nuclear companies as well as laboratories worldwide. In the last several years, personnel have prepared dozens of experimental alloys. Some of these include advanced zirconium, vanadium, and niobium alloys for the nuclear industry and titanium aluminides, niobium aluminides, as well as refractory base alloys for hydrogen storage.

Composition and microstructure of all materials can be evaluated at Wah Chang. Its physical property measurements, including hardness, bending, and tensile testing at room temperature and at elevated temperatures up to 1316°C (2400°F) under high vacuum.

**Table 1.**

Alloy Preparation	
Expertise in:	Available as:
Niobium	Buttons
Hafnium	5- g to 1 kg
Tantalum	Ingots
Titanium	5 kg to over 25kg
Zirconium	
Vanadium	
Molybdenum	

**Table 2.** These two tables describe services offered by Wah Chang's Alloy Fabrication Group.

Melting/Casting Process	Shapes
Button	Round, Square, or Cylindrical
Drop Casting	25 x 25 x 100 mm (1"x1"x4")
Consumable Vac Arc	100 (4"), 125 (5"), and (6") diameter (7000 amps max.)

**Table 3.**

The elements below are typical metals purified and alloyed by EB melting.

22 <b>Ti</b> Titanium	23 <b>V</b> Vanadium	
40 <b>Zr</b> Zirconium	41 <b>Nb</b> Niobium	42 <b>Mo</b> Molibdenum
72 <b>Hf</b> Hafnium	73 <b>Ta</b> Tantalum	74 <b>W</b> Tungsten

Wah Chang's R&D laboratory is also equipped for development of high-temperature fabrication parameters for refractory metals. Pilot scale ingots weighing 5 to 25 kg can be forged and hot rolled at temperatures up to 1600°C. Lab-scale hot working equipment includes a 3.5 MN (400-ton) controlled strain rate (0-30mm/sec) forge press and a 300-mm (12 in.) wide universal rolling mill. Extrusion, cold rolling, wire drawing, as well as swaging facilities are also available. Processing parameters for new alloys are often investigated on a pilot scale with these facilities prior to attempting fabrication of larger production-size ingots.

In addition to its powder processing facilities for manufacturing special alloy powders, Wah Chang's R&D lab is capable of developing specialty powder metallurgy products. Parts developed in the laboratory include fully dense zirconium alloy nuts and valve parts for the chemical process industry. Other R&D products include porous zirconium filters and porous niobium alloy wicks for liquid metal heat pipes. Wah Chang's zirconium and niobium alloy powders can be consolidated by hot or cold isostatic processing, mechanical pressing, and vacuum sintering up to 1650° C (3000° F). When required, Wah Chang uses completely inert gas handling to eliminate pyrophoricity problems and to minimize powder contamination. Using the hydride-dehydride process, personnel routinely make small quantities (1 kg to 50 kg) of custom alloy powders.

If your organization requires custom-made refractory alloys, Wah Chang's experienced staff is ready to help. Contact us for more information on the company's alloying capabilities and support services.