

**LEADERS
IN
TUNGSTEN
CARBIDE
AND
TUNGSTEN
HEAVY
ALLOY**



ATI Firth
Sterling
Allegheny Technologies

INTRODUCTION

ATI Firth Sterling is a leading manufacturer of tungsten heavy alloys. Since the inception of our heavy alloy production in 1958, we have continued to acquire advanced technology and state-of-the-art equipment to meet the ever increasing demands of the marketplace. To guarantee a highly skilled work force, we provide technical training to our employees on an on-going basis. Along with our technical capabilities, our company-wide commitment is to our customers.

ATI Firth Sterling markets its heavy alloys under the product trademarked name of Densalloy™. Densalloy provides the unique properties required in applications ranging from therapeutic medical radiation shielding to aircraft counterbalancing. Its nominal tungsten content ranges from 89% to 97% with the balance primarily of nickel and iron. By adding alloying elements to tungsten, Densalloy has greater ductility and better machinability than pure tungsten.

HEAVY ALLOY MANUFACTURING PROCESS

Tungsten Powder Production

All the tungsten powder used by ATI Firth Sterling is produced at our facility in Huntsville, Alabama. This minimizes cost fluctuations and helps to insure an uninterrupted supply of tungsten powder.

Tungsten powder is initially made from tungsten ore (Wolframite/Scheelite) which is chemically processed into ammonium paratungstate (APT). APT is then converted into tungsten oxide and subsequently reduced to pure tungsten powder. The tungsten powder is then mixed with the alloying powders to produce a homogenous blend of Densalloy. Each lot of powder is identified and tested for sound metallurgical properties.

Pressing

Blended tungsten powder (Densalloy) is cold pressed under controlled conditions to insure uniform compaction throughout the green compact. A variety of presses are used including dry and wet bag isostatic presses which are capable of compaction pressures in excess of 25 KSI and mechanical and hydraulic presses ranging in capacity from 15 to 1,000 tons. Also hundreds of dies and press toolings are available for use.

Green Shaping

A variety of methods including CNC waterjet cutting are used to shape green compacts prior to sintering. Green shaping produces parts which are closer to the desired size thereby minimizing cost and reducing machining of the final product. Sintering Densalloy is accomplished by a liquid phase sintering process in closely controlled hydrogen furnaces at temperatures between 2500°F and 3000°F. Sintering causes the green compacts to shrink 15% to 20% resulting in a fully dense product. Sintered material can then be machined by a large variety of conventional methods.

Machining

We have a wide range of advanced CNC turning and milling centers, wire EDM, centerless grinders as well as access to processes such as plunge EDM, metal stamping, gun drilling, double disc and blanchard grinding. We have both hot and cold rolling mills with the capability to roll tungsten heavy alloy sheet to a thickness of 0.020 inch. All of these capabilities equip us with the flexibility to satisfy the most demanding jobs regardless of size.



Engineering Services

To help enhance our customers' design process and reduce cost, we have available experienced design engineers to discuss the material selection, blank configuration, and machining ideas. Among the tools at our disposal is a state-of-the-art CAD system with full 3-D solid modeling capability for concept evaluation, mass property calculation, and complex surface machining. With this CAD system, we can work directly with our customers through their Unigraphics Operations System or auto CAD base files.

Machining Guidelines

Densalloy is similar to machining gray cast iron because the material is highly abrasive and the chips are discontinuous. Carbide tools are used for milling, turning and drilling; however, cobalt is recommended for tapping. The use of coolant is suggested for roughing but is not required for finish cutting. Cutting speeds should be in the range of 100 to 300 SFPM, and feeds should be set to maintain approximately .006" to .010" chip load. Depth of cuts for

roughing can be as much as .125" and for finishing as much as .030".

Fastening and Joining

Densalloy can be joined to itself and other materials using brazing and conventional mechanical methods. Brazing is most effectively done using nickel or copper in a reducing atmosphere.

Densalloy can also be very effectively joined to itself using a sinter bond technique. Sinter bonding essentially causes diffusion of material across the joint interface resulting in an almost indiscernible joint in the finished part.

Finishes - Corrosion Resistance:

Although Densalloy possesses relatively good corrosion resistance, slight corrosion will occur in high humidity atmospheres. Various finishes can be applied to improve its corrosion resistance. This includes cadmium and nickel plating as well as acrylic and epoxy paints.

Densalloy products are offered as machinable blanks or as finished parts, precision-machined to the customer's specifications and used in many different applications as indicated below.

Bar and Sheet Stock

ROTF (rough oversize to finish) Blanks

Counterbalance Weights/ Vibration Dampening

For industrial applications, such as:

- aircraft control surfaces
- helicopter rotor systems
- ship ballasts
- engine components
- automotive suspension systems
- computer disc drives
- golf club weights
- racing industry

Radiation Shielding Components

- collimators
- shielding blocks
- oil well logging instrumentation
- nuclear testing equipment

Machine Tools

- Densbore™



CORPORATE PROFILE

Allegheny Technologies

Incorporated (NYSE: ATI) is one of the largest and most diversified specialty materials producers in the world. The Company's talented people use innovative materials and processing technologies to offer growing global markets a wide range of

specialty materials solutions. High-value products include super stainless steel, nickel-based and cobalt-based alloys and superalloys, titanium and titanium alloys, specialty steels, tungsten materials, exotic alloys, which include zirconium, hafnium and niobium,

and highly engineered strip and Precision Rolled Strip® products. In addition, we produce general-purpose specialty materials such as stainless steel sheet and plate, silicon and tool steels, and forgings and castings.

Visit us at: <http://www.alleghenytechnologies.com>

Metalworking Products, an Allegheny Technologies Company, is one of the few companies in the industry that is truly integrated from raw material through high value-added finished products. Comprised of four targeted

business units, ATI Firth Sterling, Alldyne Powder Technologies, Stellram and Landis Threading Systems, Metalworking's vertical integration along with a focus on lean manufacturing, continuous process, quality and delivery improvement programs, has

substantially improved our ability to serve our customers in a highly competitive global market. Because of our diversity in product offerings, we are truly your tungsten alloy solution.

Visit us at: <http://www.metalworkingproducts.com>

ATI Firth Sterling was formed in 2004 by combining three well-known and very successful business units: Firth Sterling, Firth MPD and Tungsten Products. Firth Sterling has provided innovation and expertise in wear resistant tungsten carbide applications specifically for tooling blanks, rod, woodworking, die, wear and engineered products for over 75 years. Firth MPD has

focused on high quality tungsten carbide products used in oil and gas drilling as well as mining and construction applications. Tungsten Products supplies tungsten heavy alloy components used in aerospace, medical radiation shielding, auto racing and recreational applications. Because of our integration, we are capable of capitalizing on synergies within the group. As a result, we combined our

executive, sales engineering and inside sales teams to allow us to better service our customers in an extremely competitive marketplace. The new ATI Firth Sterling is better organized to bring new and innovative products to market while providing personalized service to our valued customers.

Visit us at: <http://www.atifirthsterling.com>

...your tungsten alloy solution



ATI Firth Sterling
Allegheny Technologies

1297 County Line Road • Madison, AL 35756
Tel: 800-221-4273 • Fax: 800-221-1895
Email: sales@firthsterling.com
www.atifirthsterling.com

Manufacturing Locations:

1297 County Line Road • Madison, AL 35756 • Tel: 256-464-7500 • Tel: 256-464-7500 • Fax: 256-464-7550 • Fax: 713-957-7114
481 Fire Tower Road • Grant, AL 35747 • Tel: 256-728-4222 • Fax: 256-728-2614
4435 W. 12th Street • Houston, TX 77055 • Tel: 713-957-7100