CARPENTER
Powder Products

North and South America

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CARPENTER
Powder Products

A World of Capabilities

Carpenter Powder Products metal powders are supplied to a diverse group of industries including aerospace, power generation, automotive, energy, medical, industrial and consumer applications.

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Carpenter Powder Products: Ready to Meet Your Needs

Welcome to Carpenter Powder Products! Over the past 40 years, we have established ourselves as a specialty powder metals manufacturing company that embodies excellence—in our product line, as innovators, and in our strong commitment to customer service. With extensive prealloyed powder manufacturing and metal processing experience, we are recognized as an industry leader. As part of Carpenter Technology Corporation, one of the largest and most respected specialty materials corporations in the world, we serve our customers via a global network that extends from the United States to Europe, Asia and South America.

Our world-class line of Micro-Melt® metal powders includes the most diverse group of alloys available anywhere. We are one of the largest global producers of gas atomized powder, offering the world's most versatile powder melting processes, including air induction melting, vacuum induction melting, protective atmosphere melting and plasma-heated tundish refining. We provide prealloyed powders that are tailored to meet customer requirements for thermal surfacing (overlay and hardfacing) processes, metal injection molding, net and near net shape hot consolidation technologies, and mill form products (billet, round and flat bar, wire, plate, sheet, and strip). Our manufacturing versatility and technical knowledge enable us to provide you with consistent high quality products that offer the opportunity to reduce the life-cycle cost of your products.

We are also committed to lean manufacturing and continuous improvement internally and externally, and maintain a strong environmental approach to our manufacturing processes. Our pledge is to provide you with top quality, consistent products, which meet or exceed quality standards. Certifications include ISO 9001, AS 9100, NADCAP and customer specifications.

Because Carpenter Powder Products is a one-stop supplier, you can be assured that we have the products, expertise and capabilities to provide solutions to your problems. We stock an extensive product line; everything we sell is manufactured in compliance with our demanding and rigorous quality standards. We can provide you with large or small quantities and maintain an inventory of products for your ongoing and future needs. Added value is provided with rapid turnaround and reliable delivery, extensive processing expertise and technology alliances. We can also provide you with supply chain solutions that give you the right product at the right place at the right time.

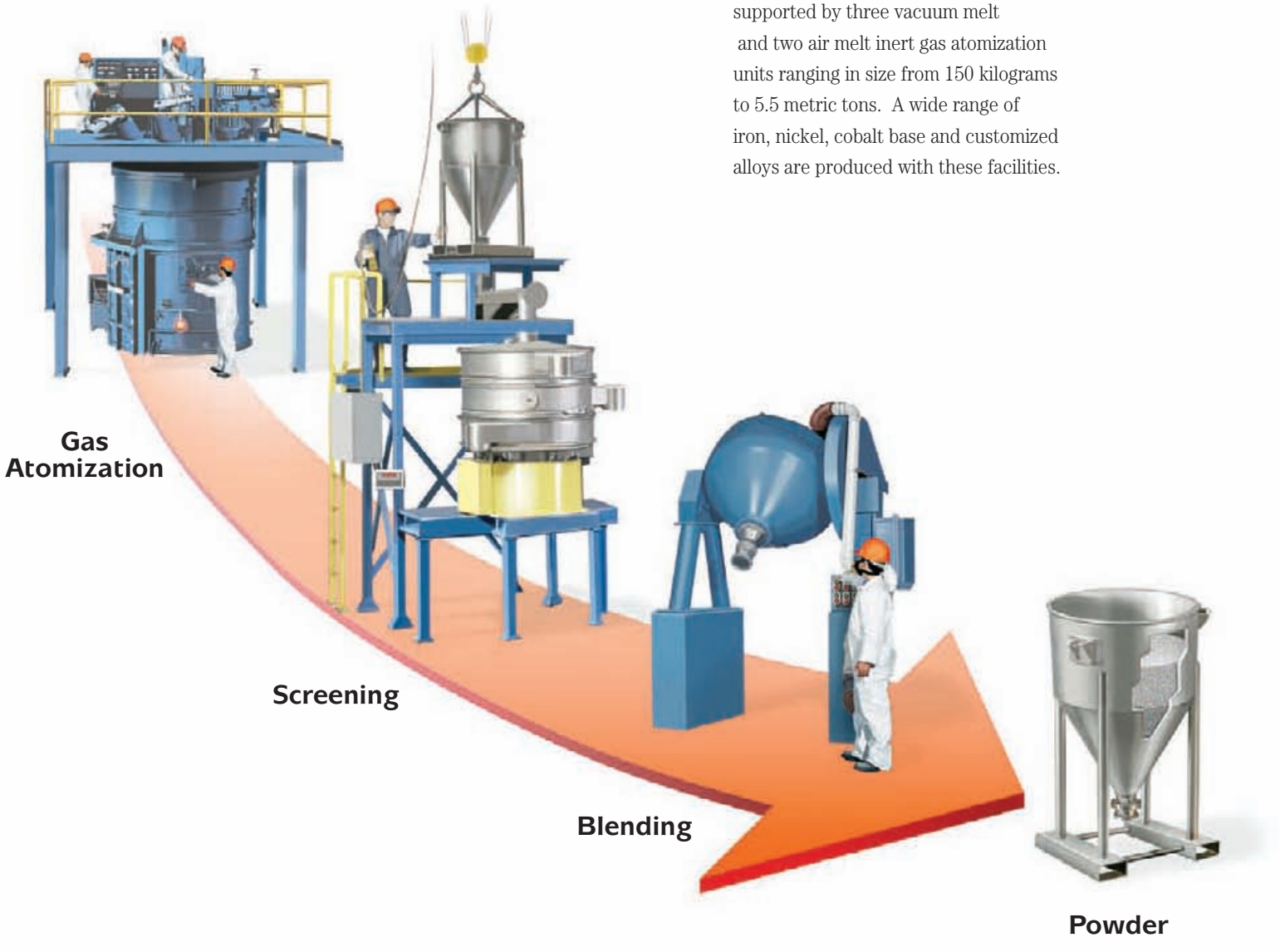
We are highly innovative and continue to explore new technologies to better serve your needs and exceed your expectations. Because we are customer-focused, we also welcome the opportunity to partner with you to develop specialty products and customized solutions. Our research and development laboratory at Reading, Pennsylvania is available to support all customer needs.

We look forward to the opportunity to discuss your needs and how we can meet them. In the meantime, please use this brochure to learn more about why Carpenter Powder Products is leading the way in metal powder development and production. We welcome an opportunity to meet with you to further discuss why Carpenter should be your primary choice for specialty metal powders.

Carpenter Powder Products is a world-class manufacturer of prealloyed gas atomized powder metal products. These products are engineered to meet the unique performance and quality demands of aerospace, automotive, energy, medical, industrial and consumer applications.

Processes & Products

Powder production capability is supported by three vacuum melt and two air melt inert gas atomization units ranging in size from 150 kilograms to 5.5 metric tons. A wide range of iron, nickel, cobalt base and customized alloys are produced with these facilities.

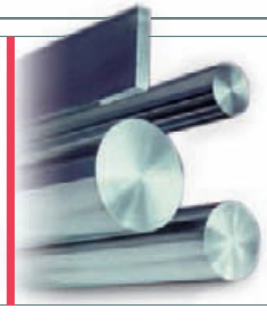


HIP'D PRODUCTS
Large round, rectangular, and complex shapes in a variety of alloys

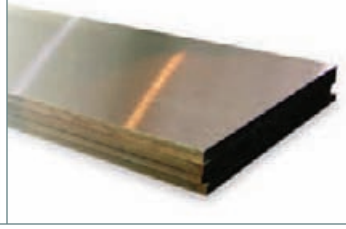
MILL FORM PRODUCTS
HIP'd shapes processed to bar, plate and strip in a variety of sizes

High Speed Steel Block

Stainless Steel Valve

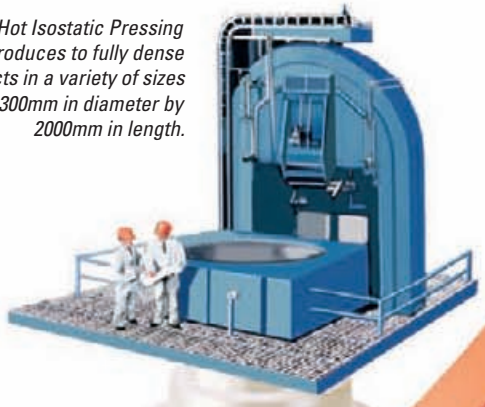


Ground Bar



Ground Plate

Hot Isostatic Pressing produces to fully dense products in a variety of sizes up to 1300mm in diameter by 2000mm in length.



Hot Isostatic Pressing (HIP)

Near Net Shapes

Hot Isostatic Pressing produces a variety of near net shapes weighing several kilograms to as large as 7 metric tons.

Hot Isostatic Pressing produces a variety of round and rectangular shapes that are processed to bar, wire, plate and strip products.

Mill Forms

A variety of gas atomized metal powders are supplied to precise particle size requirements for metal injection molding small complex parts.

Metal Injection Molding (MIM)

Precisely screened, rapid prototyping metal powders are supplied for the manufacturing of larger complex net shape parts via 3-D printing and laser sintering processes.

Rapid Prototyping (RP)

Net Shape Processes

Surface Enhancement and Joining Processes

Customized metal powders are supplied to exacting particle size requirements for all types of thermal spray, laser, PTA and brazing applications.

NET SHAPE PRODUCTS

Complex components consolidated by MIM, laser forming and rapid prototyping

SURFACE ENHANCED PRODUCTS

Thermal, PTA, HVOF and laser cladding processes

Complex Small MIM Shapes

Laser Sintered Knee Implant

HVOF Transition Duct

Plasma Spray Butterfly Valve

PTA Welded Extrusion Screw

Customized metal powders are consolidated into unique and specialized shapes to meet the most stringent requirements. These highly engineered net and near net shape products have applications across a variety of markets including automotive, energy, medical, consumer and industrial.

Consolidated Powder Products

Wear resistant Bi-Metallic Rolls for Hot and Cold Rolling Operations

HIP'd Liner for Extrusion Tooling *HIP'd Venturi Valve* *HIP'd Rolls* *HIP'd Exchanger Components*

Hot Isostatic Press (HIP) for Large Shapes

CERN Particle Accelerator

HIP'd CERN End Cap

Carpenter Powder Products' high performance prealloyed powders are consolidated into a wide variety of products. Some products, such as metal injected molded (MIM) parts, are relatively small and precise. Others, such as hot isostatically pressed (HIP) rolls, can be very large.

- HIP Consolidation Powders - CPP manufactures atomized and screened Nickel, Iron, and Cobalt base powders for consolidation by hot isostatic pressing (HIP'ing), a process that incorporates the simultaneous application of temperature and pressure in an autoclave to achieve full density. HIP consolidation can be provided by CPP via conversion partners or performed by customers who prefer to manufacture their own special shapes. Examples include large stainless steel valves, perforated paper rolls, and other complex shapes. HIP consolidated powder can also be supplied in billet form for forging or rolling into bar, or as semifinished shapes that can be machined into monolithic or composite components. Major applications include HIP'D bi-metallic or monolithic mill rolls, near net shape oil and gas components, and small complex laser sintered components.
- MIM Powders – CPP produces MIM powders in several size ranges to meet customer requirements. The MIM process, which involves preparation of a feed stock, extruding to a defined shape, and sintering to high density is used to make a wide range of products. Applications include parts for wristwatches, cellular phones, automotive turbochargers fuel injectors, airbag sensors, handguns and rifles, intricate electrical components, medical devices and dental tools. Both standard and master alloy powders are available for use in the manufacture of either feedstock or MIM parts.
- Rapid Prototyping Powders – CPP provides atomized metal powders, screened to appropriate particle sizes, for laser sintering and 3D printing processes. These processes are used to manufacture parts and molds directly from CAD data. Complex parts with internal channels, overhangs, undercuts and molds with integral and hollow cores can be rapidly manufactured.

Turbo Charger MIM Parts

Laser Sintered Exhaust Duct
Photo Courtesy of RPM & Associates

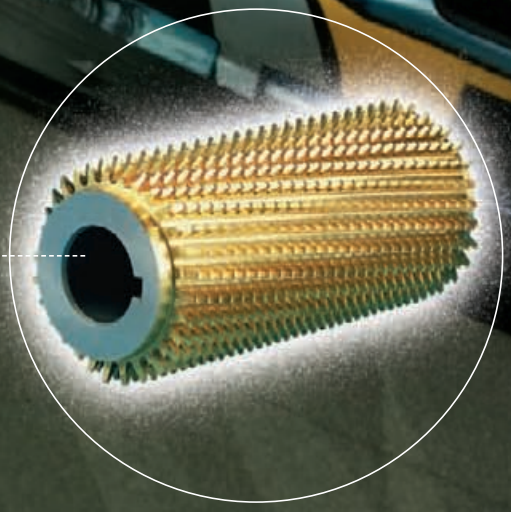
Laser Sintered Cone
Photo Courtesy of RPM & Associates

Laser Sintered Hollow
Photo Courtesy of RPM & Associates

RP Injection Mold

Carpenter Powder Products offers both Micro-Melt® powder metallurgy and cast-wrought tool steel products for all popular hot work, cold work and high speed steel applications. Bar and plate are stocked for immediate delivery.

Tool Steel Products



Automotive Micro-Melt® gear cutting tools such as hobs have been designed to face unique demands

Micro-Melt® Broach Used To Machine Pistol Barrels

Micro-Melt® Broach Used To Machine Titanium Blade Roots

Micro-Melt® Dovetail Form Tools

Rotary Forging of Large Bar

Hot Rolling Bar and Wire

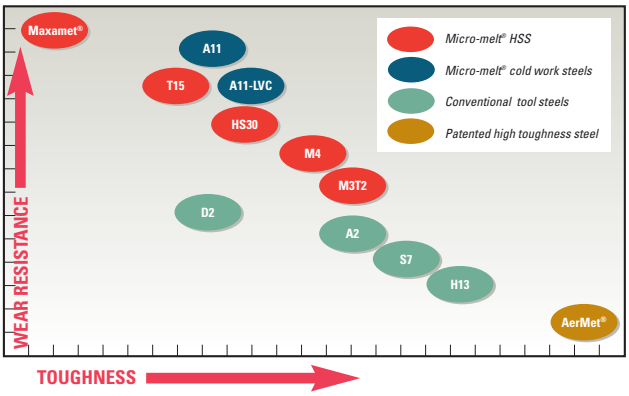
Finished Forms

Carpenter Powder Products supplies the marketplace with a wide variety of Micro-Melt® tool steel forms:

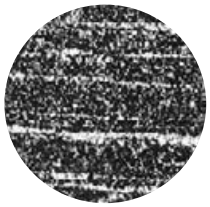
- Powders
- Hot isostatically pressed (HIP'd) shapes
- HIP'd and hot/cold worked mill form products (billet, bar, wire, plate, and sheet)

These products are used to manufacture hot and cold forming tools, cutting and shaping tools, and wear and corrosion-resistant tools. These tools require materials that possess specific combinations of hardness, wear resistance, toughness, and corrosion resistance. Traditional cast-wrought tool steel mill forms are also supplied to the marketplace.

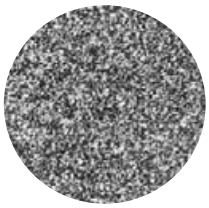
TOOL STEEL WEAR RESISTANCE-TOUGHNESS COMPARISON



Micro-Melt® tooling alloys provide a range of wear and toughness capabilities to meet customer requirements.



Cast-Wrought



Micro-Melt®

Micro-Melt® alloys offer a homogeneous, fine and super clean microstructure providing benefits to the tool maker and end user

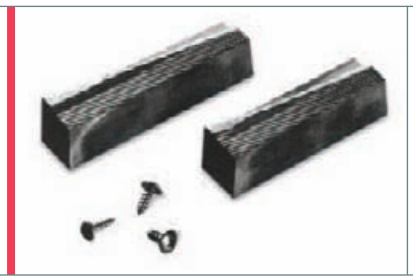
Micro-Melt® tool steel products offer these benefits to both the tool maker and end user over cast-wrought products:

- Improved machinability in the annealed condition
- Improved grindability in the hardened and tempered condition
- Improved toughness
- Improved cutting performance
- Improved wear resistance
- Improved corrosion resistance
- Improved heat treat response

These benefits are the direct result of the refined, homogeneous microstructure in the powder metallurgy product, which has virtually no segregation and contains small, uniformly distributed carbide particles and a fine grain size.

Micro-Melt® Stamping Dies

Micro-Melt® Taps and Drills



Micro-Melt® Thread Rolling Dies

Micro-Melt® Ultra High Hardness Spade Drills

Customized metal powders are supplied to OEM specifications and particle size requirements for all types of thermal spray, PTA, laser and brazing applications.

Powders for Surface Enhancement and Joining

HVOF Coated Turbine Engine Components

PTA Hard Faced Bearing

Machined Laser Clad Shaft

PTA Hard Faced Engine Valves

Offshore Oil Platform

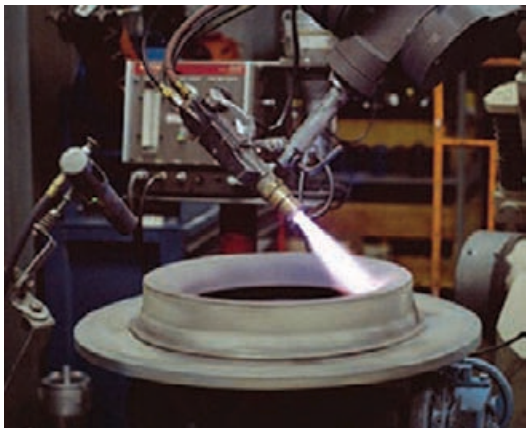
Laser Clad Structural Support for Oil Platform

Laser Clad Crusher Shaft for Oil Platform

A core part of our business is the development and production of a wide variety of state-of-the-art Micro-Melt® prealloyed, gas atomized metal powders. These powders are used in a wide range of thermal surfacing processes:

- Thermal spray processes, which include flame and plasma spraying, high velocity oxy-fuel (HVOF) spraying, vacuum plasma spraying, low pressure plasma spraying, and cold spraying
- Plasma transferred arc (PTA), hard-facing and weld overlay processes
- High temperature brazing for joining and repair process
- Plasma powder arc welding (PPAW) process
- Laser cladding for wear and corrosion resistance

These highly alloyed metal powders are used to enhance surface properties in harsh environments and to protect industrial surfaces from corrosion, oxidation and erosion due to wear and extreme temperatures. They are used in a wide range of applications, including thermal spray coatings for jet engine and land-based gas turbine components, coatings for offshore oil applications, as well as coatings for numerous automotive and industrial components. Carpenter Powder Products supplies various particle size distributions for specific needs. Customer specifications are met through a wide variety of mechanical screening and air classification procedures.

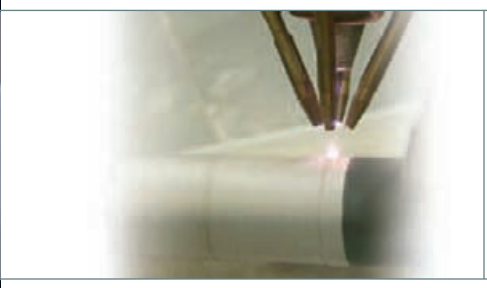


Plasma Sprayed Compressor Ring

EXTENSIVE INVENTORY OF ALLOY AND PARTICLE SIZES PACKAGED IN A VARIETY OF CUSTOMER SPECIFIC CONTAINERS

Precise Powder Packaging

LASER CLAD TOOLING



Forging Punch

Plunger

Powder Packaging Options

Customized Powder Metal alloys designed for special applications in the medical, energy and tooling industries.

Special Products

Customized Micro-Melt® alloys provide superior performance for medical products such as orthopaedic implants, fracture fixation devices and surgical instruments.

Micro-Melt® 440XH Dental Tools

BioDur® CCM Plus® Medical Implants

BioDur® Custom 470® Surgical Needles

A 2,500 Ton Press Is Used To Rapidly Consolidate Dynaforge Monolithic and Bi-Metallic Shaped Components

NeutroSorb Plus® Bars

NeutroSorb Plus® Fuel Channels

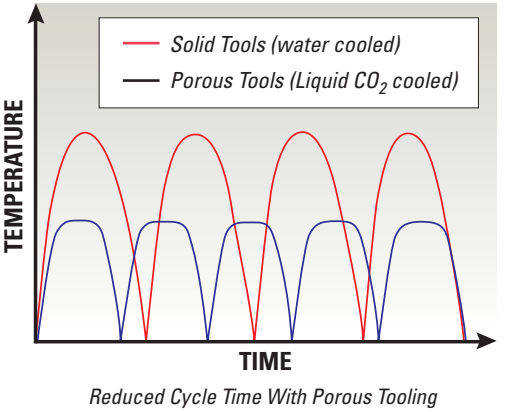
CPP's comprehensive metallurgical technology and expertise have resulted in a variety of patented and/or unique materials and processes. Some examples include:

- BioDur® CCM Plus® Alloy – a patented cobalt base alloy that provides superior wear and strength for orthopaedic implants.
- NeutroSorb Plus® Alloy – a patented, high boron stainless steel that possesses a unique combination of high toughness, corrosion resistance, and thermal neutron absorption.
- Dynaforge – a unique high-speed, high-pressure consolidation process used to manufacture advanced monolithic and functionally graded tooling materials with improved tool lives of 5X or greater in many applications.
- Porous Tooling – controlled density (porous) tooling product developed for venting and controlled cooling applications that can decrease manufacturing cycle time by 25 to 50 percent.

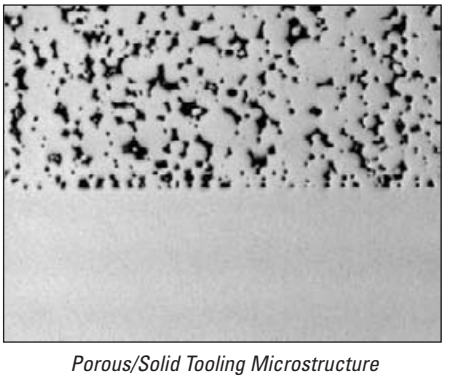
Dynaforged High Performance Tools

CPP's special products and processes enable customers to achieve unique solutions to their design challenges. The result has been many innovative products now used worldwide in the microelectronics, steel, medical, aerospace, plastics, automotive and chemical industries. CPP has the willingness and expertise to work collaboratively with our customers to assist in the development of customized products and find solutions to difficult problems. An excellent technical staff and Research and Development laboratory combined with corporate expertise in specialty materials including superalloys, stainless steels, high strength alloys, corrosion resistant alloys, and ceramics provides an unparalleled resource for our customers.

POROUS/SOLID TOOLING AIDS PRODUCTION EFFICIENCY DURING INJECTION MOLDING



Reduced Cycle Time With Porous Tooling



Porous/Solid Tooling Microstructure

Summary

Carpenter Powder Products is a unique, integrated supplier of prealloyed, gas-atomized powder and consolidated P/M products. Our products offer solutions that will enable you to increase operating efficiency and reduce operating costs. We welcome the opportunity to work closely with you to develop technology and products that address your unique needs. Customer satisfaction is our top priority. As a customer, you can be confident that you are working with one of the most respected, innovative corporations in the metals industry with an unparalleled reputation for excellence.

Carpenter Powder Products uses state of the art equipment for chemical analysis and powder particle size measurements.

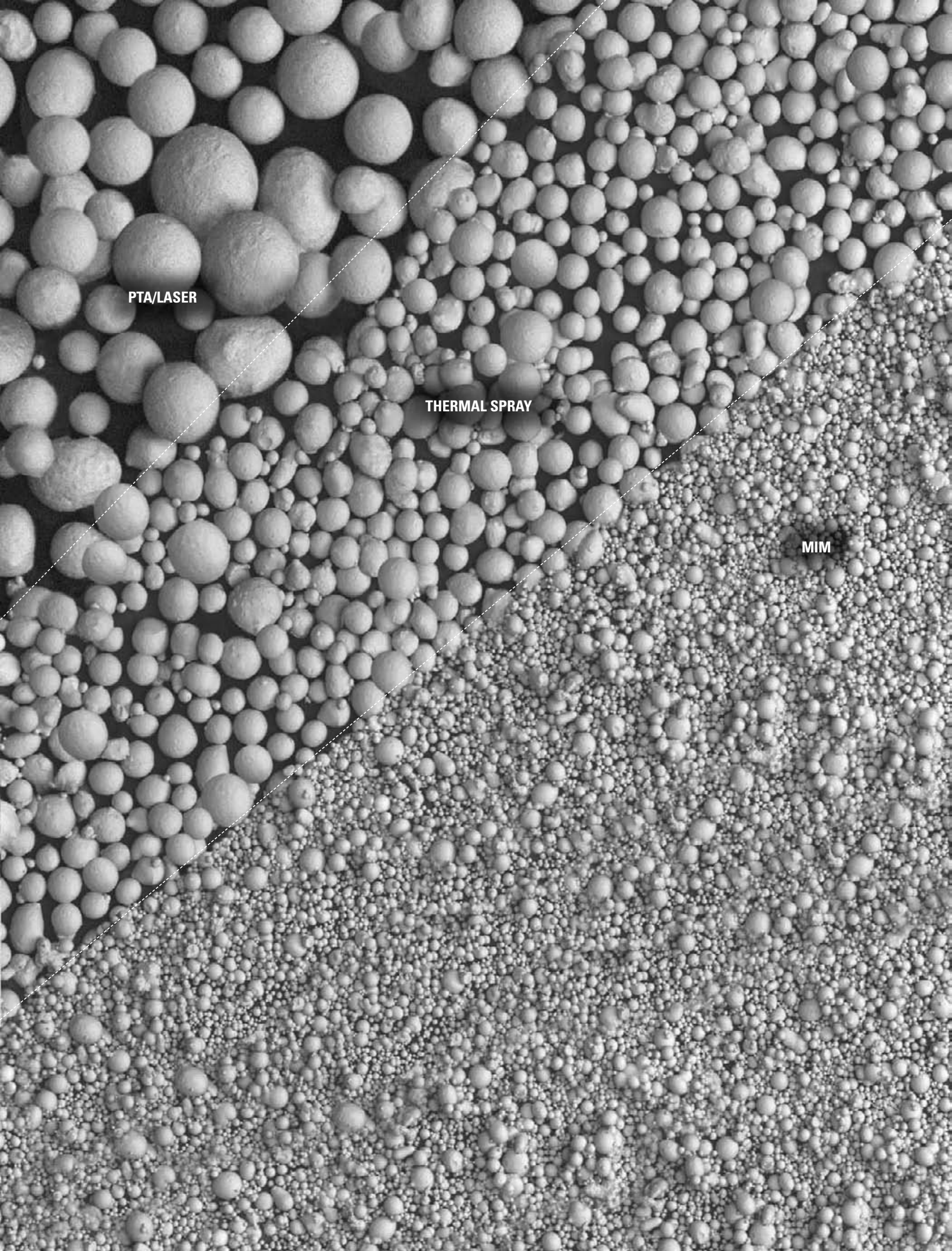
Glow Discharge Chemical Analyzer

ICP Chemistry Analyzer

Scanning Electron Microscope

Microtrac Particle Size Analyzer

Carpenter's state of the art R&D Laboratory in Reading, Pennsylvania.


PTA/LASER
THERMAL SPRAY
MIM