Desktop Metal

[Case Study]

Wall Colmonoy

www.desktopmetal.com

00

Overview

The Wall Colmonoy story begins with a pair of metallurgists, Norman Cole and Walter Edmonds, who developed an alloy called Colmonoy®. Recognizing the importance of this breakthrough, entrepreneur A.F Wall bought the Colmonoy® patent and established the company in 1938 and commercialized its early products. The first nickel-based hardfacing alloy, Colmonoy®, was used extensively in the oil industry to extend the life of downhole tools and drill bits. Further innovation followed in the 1950s with the invention of a new high-temperature nickel brazing technology, Nicrobraz®. The company became a pioneer of hydrogen nickel brazing for aircraft turbine engine components.

Today, Wall Colmonoy is a global leader in materials engineering, manufacturing a wide range of products for brazing and hardfacing, as well as precision castings, coatings, and engineered components for the aerospace, automotive, glass container, oil and gas, mining, energy and other industrial sectors.

01 The Challenge

It largely goes without saying, but when it comes to manufacturing, every industry has its own set of unique challenges.

Parts used in oil and gas extraction will face vastly different requirements in terms of strength, corrosion resistance and hardness than those used in less demanding environments, like consumer products, and meeting those needs means overcoming different manufacturing hurdles.

For all those differences, though, there are some universal objectives - like keeping costs low, reducing lead times and minimizing downtime - that remain the same for virtually all manufacturers.

With a diverse set of customers ranging from the automotive to the mining to the food industries, Wall Colmonoy is familiar with both halves of that equation.

To produce thousands of parts annually for those various industries via casting and machining, the company must not only create and maintain a large inventory of tooling, jigs and fixtures, but also be able to quickly fabricate new manufacturing aids as companies create new designs or modify existing ones.

To address those challenges while also keeping costs low and reducing lead times, the company turned to the metal binder jetting technology of the Desktop Metal Shop System™.

02 The Shop System Solution

Using the Shop System, Wall Colmonoy has been able to produce its own tooling through 3D printing its own metal parts. Wall Colmonoy has significantly reduced manufacturing downtime associated with producing tooling, and has been able to quickly make improvements to existing tooling designs.

In addition to creating tooling, the system allows the company to be far more agile by directly printing parts as new designs emerge or customer demands change.

That speed and flexibility also unlocks new levels of design freedom for Wall Colmonoy customers.

This latest purchase marks a new chapter for Wall Colmonoy, and we are inspired by the possibilities of metal 3D printing to really expand what we can make.

—

Chris Weirman
Technical Director, Wall Colmonoy

Because the technology supports a wide design space, additive manufacturing with the Shop System™ opens the door to assembly consolidation, allowing Wall Colmonoy engineers to combine multiple parts into a single printed geometry, resulting in greater efficiency and better part performance. The System also makes it easy to create parts with features - like complex curved surfaces, undercuts and unsupported arms - which would be too expensive and time consuming to justify creating with traditional methods.

Additive manufacturing also allows Wall Colmonoy to iterate on designs far faster than with traditional production methods. Using the Shop System, they can quickly print a number of versions of a part in as little as a day and test each under real-world conditions before finalizing a design, all in less time and at less cost than would be required for hard tooling or subtractive manufacturing methods.

The System also opens the door to far greater flexibility on inventory. Rather than having to store and track large numbers of tools and spare parts, Wall Colmonoy can create “digital warehouses” to hold part files, and call up designs to be printed on demand as needed.

03

Why Desktop Metal?

Before investing in the Desktop Metal Shop System™, Wall Colmonoy engineers explored the use of laser-based metal printers, and discovered a number of limitations.

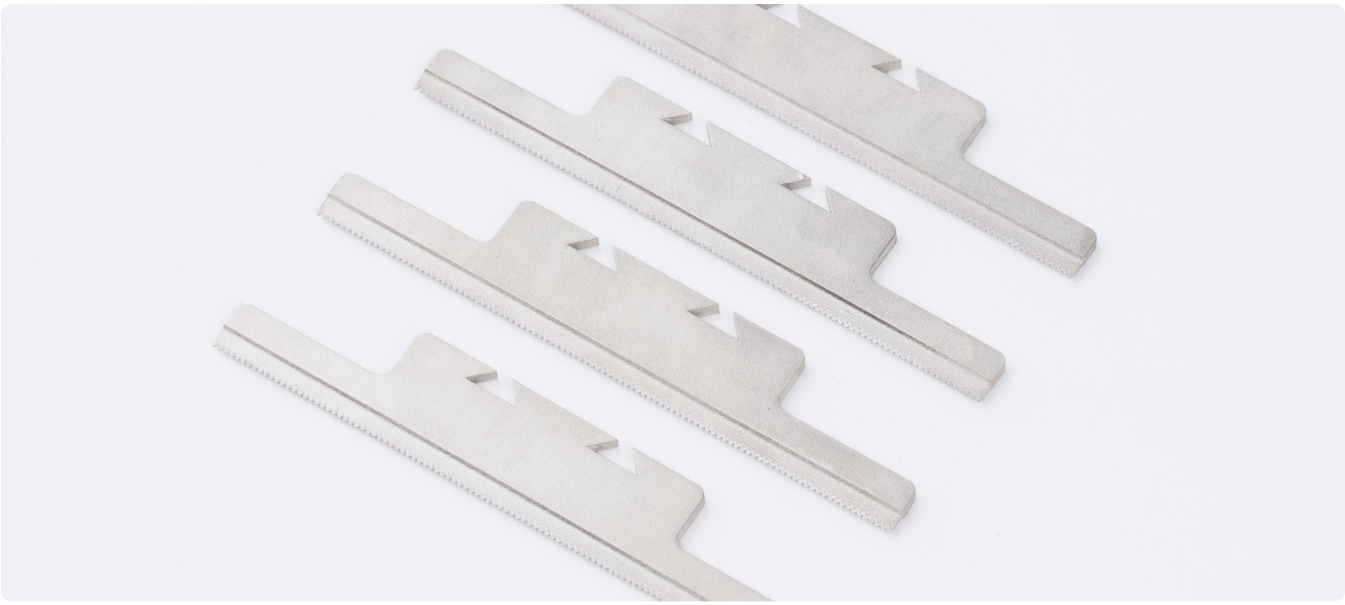
In addition to extensive post-processing needed to remove build plates and printing supports, laser-based Systems are relatively slow, resulting in low throughput and relatively high per-part costs.

The Shop System, by comparison, allowed the company to achieve far higher throughput - a key consideration for Wall Colmonoy.

Another key consideration was the fact that the System is built around well-understood and established processes used in traditional powder metallurgy - especially those used in metal injection molding (MIM.)

With long experience in powder metallurgy - particularly the sintering process - Wall Colmonoy engineers were confident in both how the System worked and in their ability to use it to produce high-quality, 3D-printed metal parts.

Part Fabrication & Comparison



Aseptic Knife

A key component used on many food processing lines, knives like this one are used to slice the laminated cardboard used in aseptic packaging of everything from milk to soup to salad dressing.

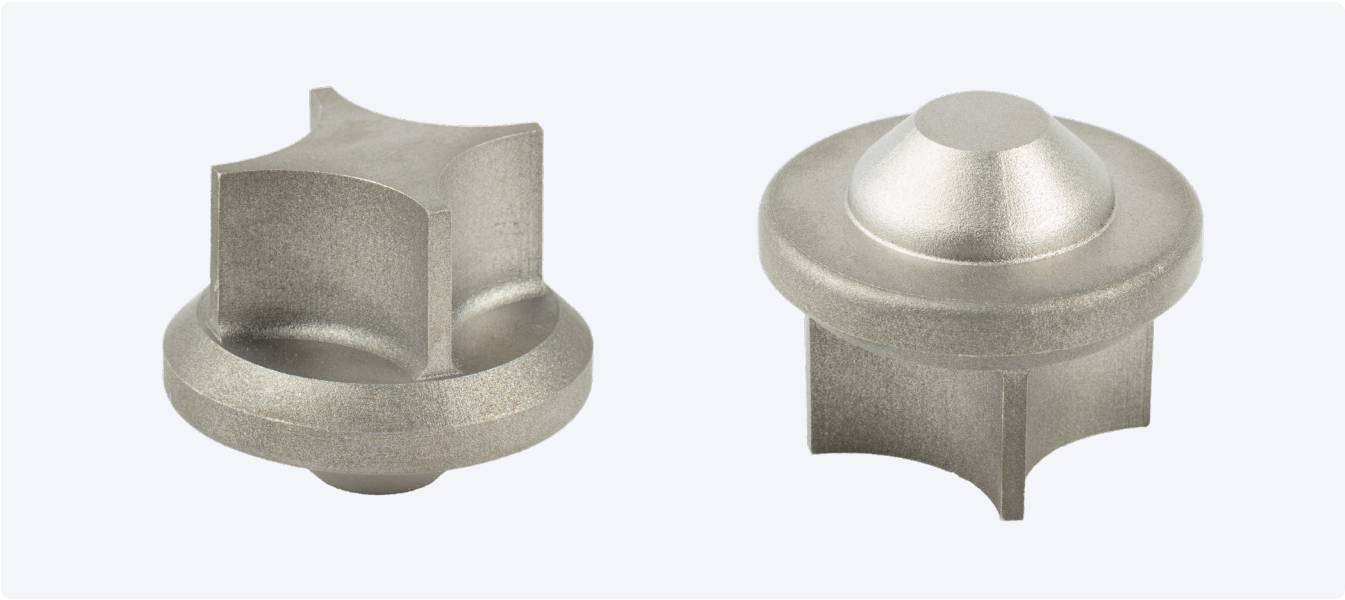
Using traditional methods like investment castings and machining, the blade and holder would be manufactured as separate pieces - a process requiring as many as 40 individual steps - before being joined into a single assembly.

Using the Desktop Metal Shop SystemTM, Wall Colmonoy is able to 3D print via binder jetting the blade as a single piece. This decreases the number of manufacturing steps to fewer than 10, significantly reducing lead time and cutting part cost by as much as half.

Though the wide variety of sizes and geometries for these knives presents a challenge for traditional manufacturing, 3D printing allows Wall Colmonoy to easily keep pace with changing customer demands. The company can print as many as 200 of these blades in a single, 8-liter Shop System build, without the logistical challenge of storing and tracking a huge tooling inventory.

This part, printed in 17-4 PH stainless steel, was created by Wall Colmonoy to test how 3D printed knives performed. For production, the company is exploring printing the part from their food-safe Wallex® 6K alloy.

Part Fabrication & Comparison



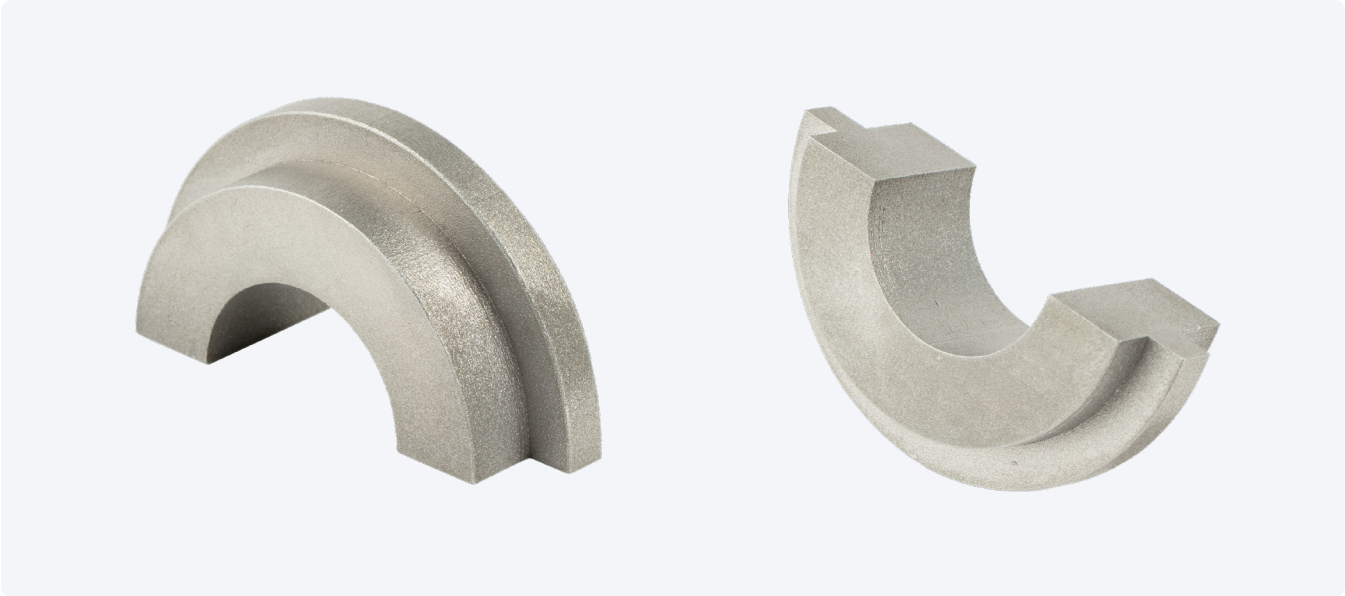
Pump Component

Components in a pumping system are typically manufactured through investment casting, but the relatively low production volume - only about 100 per week - made these parts an ideal choice for binder jet 3D printing on the Shop System.

With the Shop System, Wall Colmonoy was able to reduce the lead time for producing hundreds of this part to just one week. Traditional methods would require anywhere from three to six weeks with existing tooling, and as many as 10 weeks if tooling would need to be created.

That speed of delivery - one week versus more than two months - is a massive advantage for Wall Colmonoy, allowing the company to turn around customer orders far faster than competitors that rely on traditional approaches.

Part Fabrication & Comparison



Neck Ring

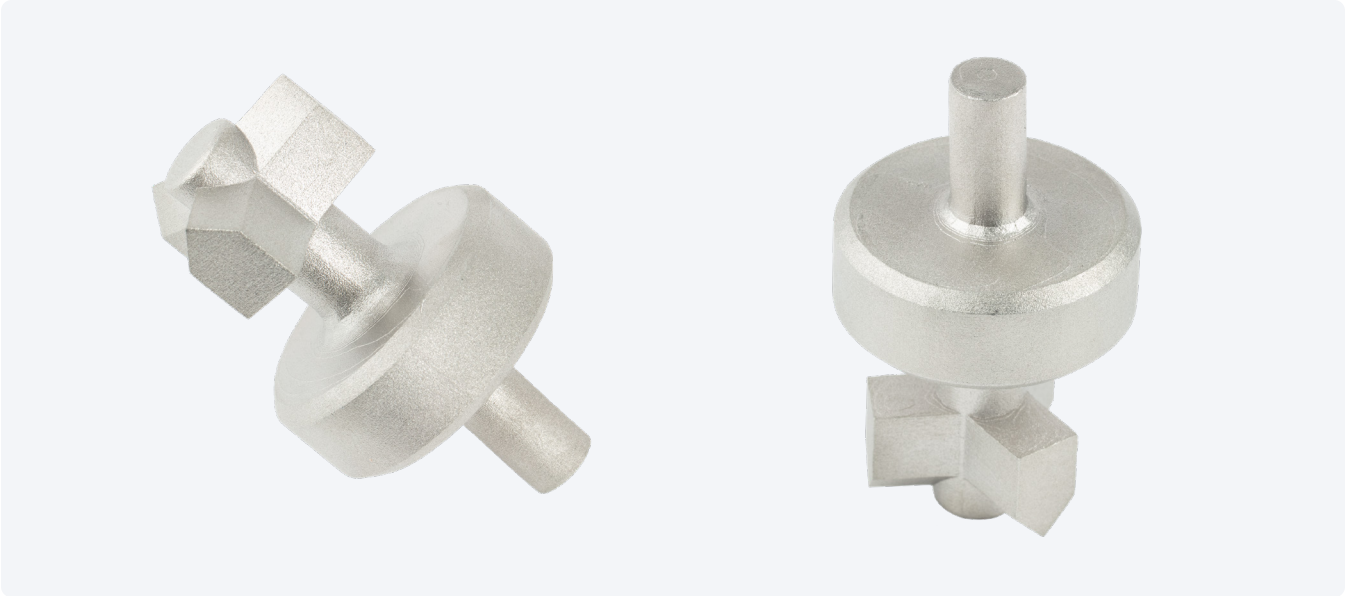
Used in the production of a wide range of glass bottles, this part is one half of a mold used to form the neck of a bottle during the blow molding process.

Though typically manufactured via investment casting, the glass bottle neck rings present a number of challenges to traditional manufacturing.

While the parts are often produced in large numbers, their designs are hugely variable, with different diameters, widths and threading, forcing manufacturers to produce specific tooling for each variation.

Using the Shop System, Wall Colmonoy is able to not only provide estimates in hours, but can have finished parts in customers' hands in just days.

Part Fabrication & Comparison



Homogenizer Valve

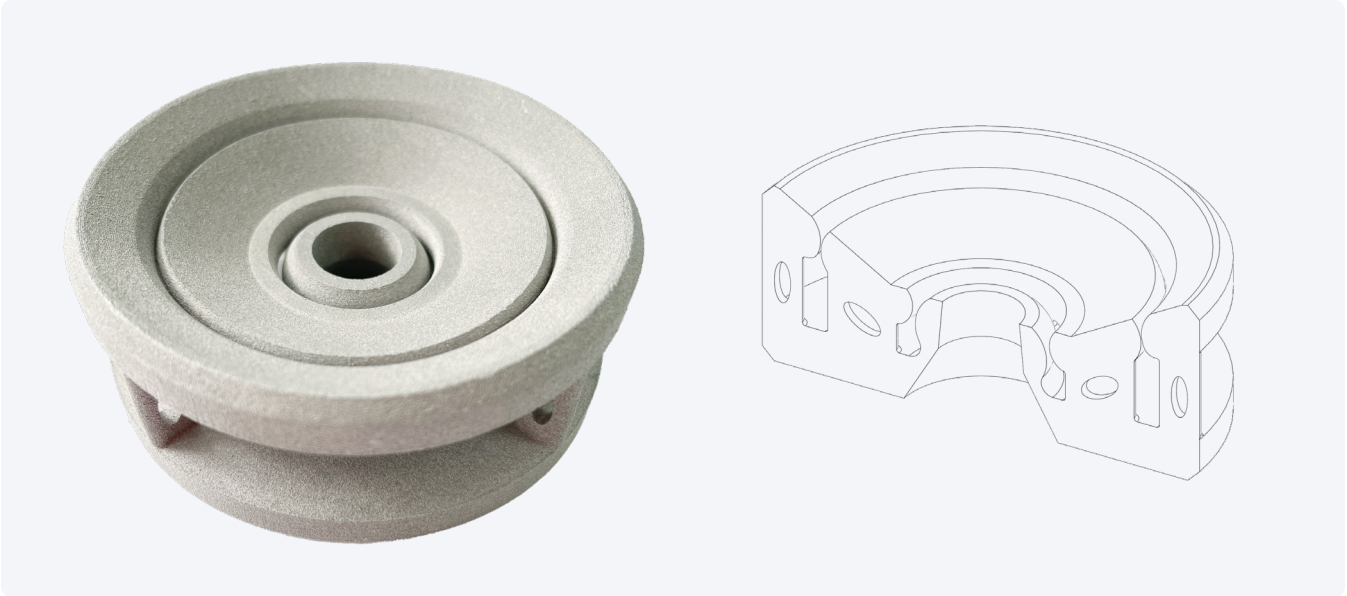
Homogenizer valves like this one are widely used in the food industry to help distribute a substance, like the fat globules in milk, uniformly throughout a liquid.

Normally cast, the process is slow and expensive for this part, as it requires complex, multi-component tooling to create the valve's intricate shape, which features undercuts and unsupported arms.

Depending on the application, these valves can take a wide variety of sizes and geometries, leading to logistical challenges in maintaining and tracking a large tooling inventory.

By eliminating the need for tooling, the Shop System allows Wall Colmonoy to produce valves like this one with significantly reduced cost and lead time. 3D printing also allows for new design creation that optimize the valves' performance by incorporating features that would be difficult to justify with traditional manufacturing but come at no added cost with printing.

Part Fabrication & Comparison



Atomization Nozzle

In addition to printing parts for a variety of customers, Wall Colmonoy is using the Shop System to develop this innovative atomization insert for producing metal powder.

In the atomization process, molten metal is passed through a nozzle, which releases the molten stream into a jet of nitrogen gas, transforming the metal into fine droplets that cool to form a fine powder.

Using different inserts to influence the velocity of the gas, producers are able to manipulate powder characteristics like particle size and uniformity.

Using the Shop System, Wall Colmonoy engineers are experimenting with new insert designs to produce finer powders.

By printing its own atomization parts on-site, Wall Colmonoy has accelerated productivity improvements that would have been impossible without 3D printing. The fast printing of parts means that new iterations can be printed and tested quickly, producing data to drive fast-paced learning.

This research and development atomization insert is designed not only to reduce the potential for satellite particles in inert gas atomization, but also to create conditions for the generation of supersonic inert gas speeds from subsonic supply.

The end result of the new design is not only greater atomization force and the generation of finer powder products with lower consumable gas use, but increased powder yields - particularly for fine, AM-grade powders, and an improved Hausner ratio due to the improved morphology.

04 Evaluation

The Desktop Metal Shop SystemTM has been a significant success for Wall Colmonoy in its first foray within additive manufacturing.

In addition to allowing the company to significantly reduce the cost and lead times associated with producing their current catalog of parts, additive manufacturing using Desktop Metal Shop SystemTM the opens new design opportunities for optimized parts with features that would be too expensive to justify with traditional manufacturing.

The Shop System has also allowed Wall Colmonoy to look critically at parts they currently cast - like pump components which are manufactured in relatively small quantities - and potentially shift them to additive manufacturing. The change can not only simplify the production of the part, but also opens up casting capacity for other parts.

Wall Colmonoy has also used the Shop System to grow their business by taking on jobs - particularly low-volume requests - that previously would have been no bid due to unjustifiable tooling costs.

About Desktop Metal Inc.

Desktop Metal, Inc. is accelerating the transformation of manufacturing with end-to-end metal 3D printing solutions. Founded in 2015 by leaders in advanced manufacturing, metallurgy, and robotics, the company is addressing the unmet challenges of speed, cost, and quality to make metal 3D printing an essential tool for engineers and manufacturers around the world. In 2017, the company was selected as one of the world's 30 most promising Technology Pioneers by the World Economic Forum, and was recently named to MIT Technology Review's list of 50 Smartest Companies. For more information, visit www.desktopmetal.com.

About Wall Colmonoy

Wall Colmonoy has been a leader in the development and manufacture of superior hardfacing alloys, brazing products, precision castings, coatings, and engineered components across a wide range of industrial sectors. With more than 80 years of engineering expertise and a progressive, visionary outlook, Wall Colmonoy delivers solutions that play an integral role in industries instrumental to our everyday lives – fundamental in keeping aeroplanes in the sky, glass bottles in production, our food fresh, pumps pumping, nuclear turbines powering, and our transportation greener.