HOW METAL 3D PRINTERS ARE USED IN MANUFACTURING ②

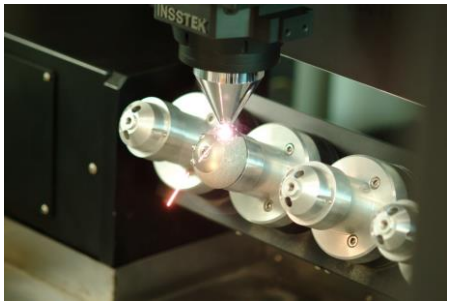
MEDICAL AND AEROSPACE INDUSTRIES HAVE OPENED NEW OPPORTUNITIES WITH METAL 3D PRINTING

This is the second article from InssTek, Inc., a metal 3D printer manufacturer in Korea, following up on the case introduced in August of using metal 3D printing in the automotive industry. This journal approaches 3D printing from a different perspective as it introduces cases from the medical and aerospace industries and sheds light on how 3D printing is succeeding where conventional manufacturing could not solve - cutting down the time and cost required for the producing various parts used in the industry.
Editor_Kim, Sol, Source_ InssTek, Inc.

According to Wohlers Report 2017, which is recognized as one of the most reputable reports in 3D printing, the aerospace, medical and dental industries are the most active fields using 3D printing technology. The aggressive application of 3D printing technology in the aerospace and medical fields is possible, since they are high value-adding industries that can afford the high costs involved with 3D printing technology, as well as high demand for customized parts. As such, they are the best industries to apply 3D printing technology in producing a wide variety of parts in small quantities. This is the second article to introduce the use of 3D printing with InssTek, Inc. Here, the article will introduce examples of using 3D printing in high value-adding industries in Korea.

ARTIFICIAL JOINTS, BIO-ACTIVATED BY 3D PRINTING

Titanium alloys, which are widely used in artificial joints, have excellent mechanical properties. They are highly resistant against corrosion and fatigue. However, they do suffer from one issue - bones do not attach properly as titanium alloys have no bio-activity. It is possible to create surface structures with the fine bone pores, which increases adhesion, using post processes such as plasma spray coating or bead coating.
CORENTEC, a Korean artificial hip joint developer, was also using the plasma spray coating method to solve the above mentioned adhesive issue. Time and cost requirements were significant using the traditional method, for which the coating process had to go through foreign vendors. However, with the introduction of InssTek Additive Manufacturing technology, CORENTEC has been able to improve quality and reduce cost. It reduced cost by more than 70% and shortened production time in medical applications since the Machines for Porous Coating (MPC) developed by InssTek, were capable of executing this sophisticated coating process. In addition, quality improved significantly compared to the existing coating method.

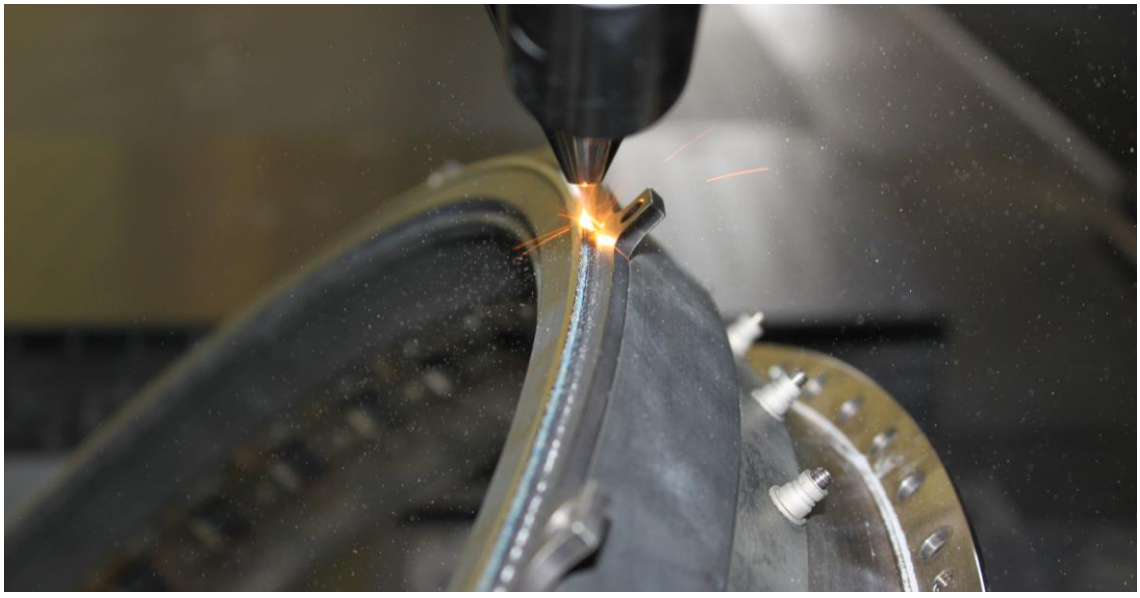


Also, conventional coating methods entail certain risks. For instance, external factors can influence the bonding layer, causing adhesion problems with the coating layer and the material. However, Direct Metal Tooling (DMT) technology, which allows different metal powder alloys to completely fuse and solidify rapidly in almost any type of surface, provides superior bonding

properties compared to conventional coating methods when applied to hip joints. DMT enhances quality and mechanical properties for better and lasting applications.

COST SAVING WITH LONGER LIFETIME FOR PARTS USED IN THE DEFENSE & AVIATION INDUSTRIES

One promising feature of the DMT Additive Manufacturing process is that, it will be able to repair and maintain metal parts and accessories which were disposed due to partial or permanent damage. In the defense and aerospace industries, where time and cost of production could be substantial, using DMT technology could be considerably more cost efficient, effective, and environmental friendly by recycling parts.



One of the most important cases from Korea in this area involving InssTek is the repair of an HPT shroud support part for an F15-K aircraft equipped with a General Electric (GE) F110 Engine for the Korean Air force. When damaged, one of the engine parts had to be replaced. Each replacement cost around USD 40,000 and took at least three months to be fully re-installed. Introduction of InssTek's DMT technology in 2015, however, has proven to reduce maintenance cost and production time significantly for the Korean Air Force.

General Electric Co. (GE) certified DMT technology to repair parts using materials such as Inconel718 and Stellite25, enabling the production of high-quality alloys by improving mechanical properties and by adding final products. This allowed InssTek and the Air Force take a step forward from conventional procedures, prompting them to explore new areas where Additive Manufacturing had been limited before.

The Air Force has an annual contract with InssTek to repair and recycle parts, which reduces maintenance period by 78% and saves more than KRW 350 million (USD 350,000) per year.

There are also cases where the cost and time for replacing damaged parts of an engine's air seals have been reduced by performing corrective maintenance solutions using DMT. For these cases, which used the Ti-6Al-4V material, the mechanical properties and the effectiveness of DMT were certified by the original manufacturer (Pratt & Whitney). The Air Force reduced the

cost of replacing 12 parts by saving more than KRW 100 million (USD 100, 000), and also shortened the maintenance period by 75%.
The repair of the Vulcan cannon of the Army Maintenance Depot is another example. The Vulcan cannons are disposed when the gun housing is worn out. Constant wear of the gun housing means Vulcan cannons consume considerable amounts of time and cost. With 3D printing technology, the worn out parts can be repaired using the same metal powder, saving time and money.

Even the parts with small damage on the surface have to be replaced with a high-cost supplier from foreign vendors. With DMT breaking through conventional limitations, 3D printing is giving access to new approaches and opportunities on many of these problems that conventional techniques have not been able to solve.