HOW METAL 3D PRINTERS ARE USED IN MANUFACTURING. PROLOG

WHY ARE INDUSTRIES RELUCTANT TO USE 3D PRINTERS?

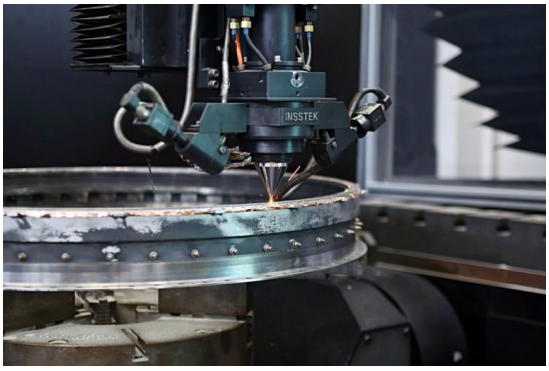
3D printers are already widely used for design, research, and application development. Then, why is 3D printing technology, which is considered to be a core technology for the 4th industrial revolution, moving along at a slower pace, particularly at manufacturing and production sites? While some companies hesitate to introduce this new technology for a number of reasons, more and more people are benefiting from the innovation that 3D printers bring...

Editor_ Kim Sol, Photos_Kim Ran-yeong

3D printers are advantageous as they offer more freedom when creating various forms and shapes compared to previous processing methods, and they have a more compact work process. In light of the 4th industrial revolution, which considers digital manufacturing as one of its keywords, 3D printers are gaining more attention as the vanguard of innovation in manufacturing. Despite several blueprints laying out the future of our manufacturing industry transformed by 3D printers, in reality, 3D printers have yet to spread across manufacturing sites in Korea for production purposes at a rapid rate except for research, development, and design applications. In response, Sung-Yoon Jung, the Chief Operating Officer of InssTek, a leading Korean company in metal 3D printing, pointed out two issues.

"First of all, one problem could be the fact that we have focused on point solutions so far. It is hard to bring groundbreaking innovation just by introducing a single 3D printer. 3D printing is also a part of the manufacturing process, so it must be able to form complementary relationships with existing equipment or processes in the production line. This will enable us to address issues we could not solve using existing measures effectively. To do so, companies that provide solutions need to consult and support the entire process, rather than deal with 3D printers independently. Another problem stems from the conservative culture prevailing in the industry. In the future, if industries adhere to existing methods, it is clear that their rate of return will continue to diminish. However, the fact that companies are failing to recognize the need to introduce new methods at the moment as nothing seems particularly wrong with long-proven incumbent measures is concerning. I think we need to create a culture that can be more aggressive in terms of innovation."

3D PRINTER THAT GENERATES REVENUES



Factors that slow down the introduction of new technologies in the field may be more diverse and complex than the two described above. However, in more realistic terms, uncertainty regarding the return on investment capital may be the biggest reason of them all.

Nevertheless, the increasing number of successful instances implementing 3D printing technology is enough to not only help people better understand the various ways of using 3D printing technology, but also eliminate any economic uncertainty. The following case is a good example.

The High-pressure Turbine Shroud Support is a component used in South Korean Air Force's F-15 Fighter. Each time it was damaged, it cost roughly KRW 40 million (USD 40,000) and took a

minimum of three months to replace it with a new part. Since 2015, however, InssTek's 3D printing technology has been used to save time and money.

Generally, Powder Bed Fusion (PDF), which is a commonly used 3D printing method, creates a part by repeatedly sintering or melting the material powder laid down to a certain thickness by selectively irradiating a laser. On the other hand, Directed Energy Deposition (DED) which is used by InssTek is a method in which metal powder is supplied to a molten pool, which is produced when a laser irradiates a metal surface. Once supplied, the powder must be completely molten down, then solidified rapidly. In other words, it involves melting the layer stacked below and then adding a new layer on top. DED is advantageous in that the structure is fine and dense, and the mechanical properties are outstanding. Furthermore, any shape can be layered on top of it again, and there is no limit to the size of objects, making it more flexible than the PDF method. InssTek combines this DED method with a Closed Loop Control function that controls the variables involved in the work process affecting the height of the metal layer stack in real time to offer greater precision in terms of thickness compared to other DED type 3D printers.

The Korean Air Force uses its proprietary DMT® technology which includes unique control features to restore parts to their original state by layering metal precisely onto the worn-out parts. With repairs completed using 3D printing technology, the parts not only recovered outstanding quality and mechanical properties which earned them GE certificates, but also drastically reduced maintenance period and cost. The maintenance period, which previously took three months, has been slashed to 20 days, minimizing any gaps in our fighting power. The Air Force is also saving more than KRW 350 million (USD 350,000) per year.

InssTek, uses its main model MX-600 to engage in the system business as well as the service business including the manufacturing, remodeling, maintenance work, etc. It also carries out research and development projects. Apart from the F-15 repair case, InssTek has a number of references across various industry fields in both Korea and abroad. MFG will showcase a wide range of references provided by InssTek over the next three articles, discussing the diverse ways in which 3D printers can be used at manufacturing sites and the impact of innovation through 3D printers.