CERAMIC ADDITIVE MANUFACTURING: SCALING UP FROM PROTOTYPING TO INDUSTRIAL PRODUCTION

Along with enabling the short-term prototype manufacturing and small-scale series production of functional ceramic parts, Lithography-based Ceramic Manufacturing (LCM) technology is also a solution for the high-volume throughput of individualized customized applications.

In industrial production, Additive Manufacturing (AM) cannot be viewed as a replacement of traditional forming technologies instead, it works as a complementary technology with its own set of rules. The true value of AM can, in fact, be highlighted when new applications are developed which are tailored to AM. If parts were redesigned from scratch, innovative applications could be developed and the true potential of AM would be made clear.

Lithoz supports its customers in the development of new application areas, as well providing the infrastructure to take customers' product to the next level: industrial production of individually customized parts.

INCREASING PRODUCTIVITY OF THE AM PROCESS

In the case of high-volume production, industrial companies face permanent cost pressures. Therefore, increasing the building speed and productivity of the AM process is a key factor in reducing production costs and overcoming the obstacle preventing the widespread use of AM for ceramics at an industrial scale.

Depending on the characteristics of the part, a significant reduction of manufacturing time and consequently costs can be achieved while still maintaining the desired level of product quality.

This is carried out by fine-tuning typical process parameters such as layer thickness, light engine settings and waiting times.

INCREASING PRODUCTIVITY OF THE AM PROCESS

Lithoz provides AM systems and solutions such as the UHC, softwares with advanced parameter access as well as in-house expertise and guidance, providing strong tools for productivity, scalability and enhancement.

Lithoz supports its customers by developing new parameter sets based on specific applications, in order to enhance productivity but still maintain essential requirements (for instance surface quality, mechanical properties, accuracy and resolution) on a case-by-case basis.

A CASE STUDY

THE APPLICATION

Static mixers are used in mixing and reaction processes to manipulate fluid streams and bring mixture components into close contact. Ceramics offer excellent and more durable solutions for mixing applications where high temperatures and good chemical and wear resistance are necessary.

STARTING POINT

Thanks to LCM technology, a prototype of a static ceramic mixer was produced, with innovative features for excellent mixing efficiency and reduced pressure loss.

OPTIMIZATION RESULTS

Once the feasibility of the part was assessed, the challenge was to increase the printing speed and productivity:

Advantages of the innovative 3D printed ceramic nozzles

- Increasing printing layer thickness from 25 µm to 100 µm → sped up the process by a factor of 4
- Switching from CF 7500 to CF 8500 → increased output by a factor of 3
- Optimizing process parameters and using a Ultra High Contrast System (UHC) → sped the printing velocity per layer by a factor of 2

CONCLUSIONS

By focusing on process settings, the production output was increased by a factor of 24, significantly reducing the time taken to produce the ceramic mixers but still maintaining the necessary complex features and mechanical properties.

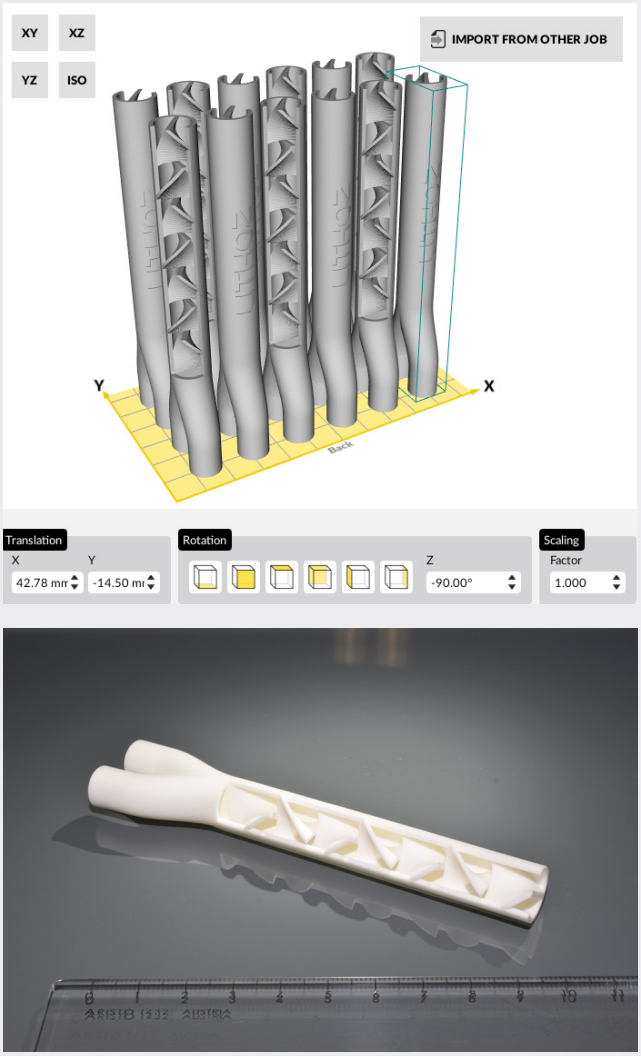

Figure 1: Static mixer (demo) produced using CeraFab 8500 in LithaLox 350D. Job preparation (above) and printed and sintered part (below). By optimizing the process settings, the production output was increased by a factor of 24 and the technical requirements were maintained.