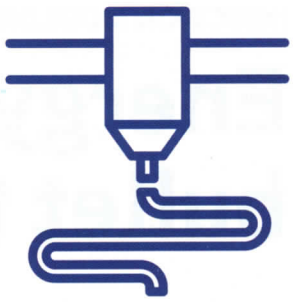
METAL INJECTION MOULDING

3D printed tool with embedded functionality



The Chair of Microfluidics at the University of Rostock is working together with Stenzel MIM Technik on a project to print a 3D metal injection moulding (MIM) tool. The basis of the development is the use of Aim 3D's CEM technology with an Ex-AM 255 system.

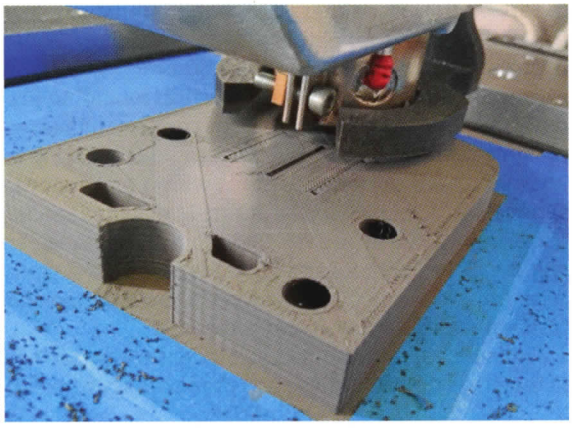
As part of a project funded by the German Federal Ministry for Economic Affairs and Energy (BMWi), a 3D printed MIM tool is jointly developed by the Chair of Microfluidics (LFM) at the University of Rostock and Stenzel MIM Technik. The duration of the project is from April 2021 to October 2023. The basis for the process and application is the use of the CEM technology from Aim 3D, implemented on an Ex-AM 255 system. The project represents the current state of the art in 3D metal printing.

The goal of the project was to use 3D printing to manufacture a tool for metal injection moulding with near-contour cooling. In 3D printing, near-contour cooling can be incorporated as a so-called functional integration with helical channels directly in the tool. In other words, it is not embedded as inlets, as is the case with larger tools. The goal of any near-contour cooling of injection moulds made out of metals or polymers is to significantly reduce the cycle time. The principle of near-contour cooling is to guide coolant fluids through near-contour cooling channels with low cross-sections. They cool the component already during the cycle. This leads to a faster demoulding process, which significantly shortens the cycle. The complex geometry of the helical cooling channels is created with the help of CAD technology using simulation models that are based on the needs of the component. Long-term experience shows a reduction in cycle time by around 20 percent, depending on wall thickness and size.

Near-contour cooling

As an integrated component solution, 3D printing offers the advantage of a one-shot technique as a functional integration compared to mould-bound processes. The application example therefore demonstrates an opportunity to drastically reduce the time-to-market. The aim of the cooperation project is to develop a new process chain for the cost-efficient and rapid production of MIM tools. Up until now, time periods of up to eight weeks have been needed to produce a conventional metal injection mould. With 3D metal printing, the provision time of a MIM tool can be reduced to about five days.

As part of the cooperation, an optimised 3D model of the tool was initially developed using CAD and simulation tools. This data was then transferred to the Ex-AM 255 CEM system, together with the necessary process parameters. A so-called green part is then 3D printed. Afterwards, the part is sintered in a multi-stage process to produce the final material properties. With this process, complex metallic components can be rapidly produced after the necessary debinding and sintering steps. At the same time, the CEM process allows for the control of the volumetric shrinkage associated with sintering. The resulting mould has a cavity. The component consists of a thick-walled part with thin fins. These fins cannot be produced without near-contour cooling, as they are difficult to demould. Stenzel MIM Technik hopes to achieve a significant reduction in cycle time for this component by up to 70-80 percent. However, injection moulding trials for testing are still pending.



Source: Aim 3D

A 3D tool for metal injection moulding being produced on an Ex-AM 255.

The multi-material 3D printer Ex-AM 255 can be used with a variety of different materials and with various processes (hybrid components). Compared to powder bed processes or even other 3D printing processes that use filaments, systems using the CEM process achieve tensile strengths that come close to classic thermoplastic, mould-bound injection moulding. The price advantage of 3D printing is particularly striking when commercially available granulates are used instead of filaments. When granulates are used, the CEM process leads to cost savings of up to a factor of ten. *(ast)*

ETMM-TIP

Learn more about Composite Extrusion Modelling (CEM) at www.aim3d.de