From a technological leap to a new mainstay

At H&B Electronic, a globally operating and certified manufacturer of high-precision components for electromechanics, industrial electronics, medical technology and other pioneering technologies, quality and economy go hand in hand. The family-run company made the decision to introduce metal-based 3D printing in their production - with the TruPrint 5000 from TRUMPF. "We have very high standards for the quality and cost-effectiveness of our plastic components and thus our injection molding tools. That is why we are increasingly relying on the combination of conformal tempering and the hot work tool steel 1.2343. We were only able to meet these requirements with the help of TRUMPF," says Thomas Weinmann, Additive Manufacturing Specialist at H&B Electronic.

H&B Electronic GmbH & Co. KG

www.h-und-b.de

In 1984 H&B Electronic was founded as a manufacturing company for electromechanical components. H&B develops and manufactures precision technical components, connector systems and assemblies exclusively at the Deckenpfronn site on approximately 13,500 m², at the edge of the northern Black Forest. Their production is customer-specific - with the highest level of precision and in all dimensions. For 30 years, the owner-operated company has been characterized by continuous growth.

INDUSTRY

Components for electromechanics, industrial mechanics, medical technology

NUMBER OF EMPLOYEES

340

LOCATION

Deckenpfronn (Germany)

TRUMPF PRODUCTS

- TruPrint 5000

APPLICATIONS

- Metal-based 3D for injection molding tools

Challenges

At H&B, around 340 employees use injection molding to produce, among other things, plastic housings for automation technology. The external appearance is one of the important factors. For example, in an actuator sensor box manufactured to order by H&B, diodes are located behind a transparent plastic window. In this case, the tool requires many delicate conformal cooling channels so that the plastic can release its heat in a controlled and uniform manner during production and cool down quickly. This is because the type of plastic used in this application becomes milky if it is cooled too slowly. The general

rule for cooling in injection molding is: as fast as possible, as homogeneous as possible. Homogeneity results in quality and speed shortens the cycle time, reducing unit costs.

The company has previously used the mold without conformal tempering, but has repeatedly had to contend with cloudy windows and a high proportion of rejects. Although the tooling experts at H&B have been using printed inserts with conformal tempering in various molds for some time, they were not satisfied with the maraging steels available to date for the L-PBF process, particularly 1.2709. Therefore the decision was made to utilize additive manufacturing with the hot work tool steel 1.2343, a well-known and popular steel among toolmakers - and to do so on the company's own 3D printer.

Compared with the maraging steel 1.2709, tempering steel H11 (1.2343) has several advantages, for example in terms of wear resistance, thermal conductivity, red hardness, temperature resistance and polishability. Its final material properties are adjusted by tempering, therefore it is more suitable for mold-making applications. However, due to its higher carbon content and the resulting inferior weldability, it places high demands on the L-PBF process used.

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THOMAS WEINMANN
ADDITIVE MANUFACTURING SPECIALIST AT
H&B ELECTRONIC

Solutions

Here is where the TRUMPF TruPrint 5000 comes into play: With its 500 °C preheating, it enables reliable processing of carbon-containing tool steels, such as 1.2343. The TruPrint 5000 heats the substrate plate to 500 °C and maintains the plate and printed substrate at this temperature during additive layering. This prevents the solidifying material from falling below temperatures at which hard, brittle martensite forms after the laser beam has melted the powder. The commercially available printers with 200 °C preheating are not sufficient for containing the temperature gradient in this way. In the worst case, the result would be a component that is filled with cracks and is unusable.

Thomas Weinmann is delighted over an additional bonus: "Due to the additive structure - partially generated weld pool, multiple partial remelting of underlying layers and the layer-by-layer rotation of the laser paths - we obtain a fine-grained metal structure similar to that of the conventional electroslag-remelted (ESR) version of the tool steel."

Implementation

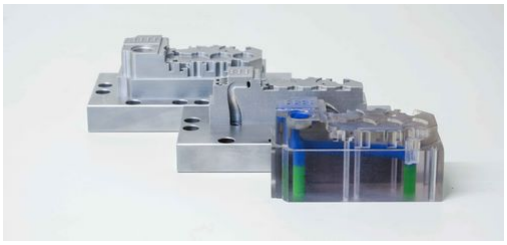
Additive manufacturing starts where conventional subtractive manufacturing methods reach their limits. With the Preform Basic option, H&B can combine the advantages of both processes. For example, a mold core manufactured by H&B has tempering channel components in the lower area that run vertically

upwards and can also undergo conventional drilling in this area. However, the subsequent tempering channel part must be manufactured additively because it is not possible to drill around the corner.

To produce the mold core, H&B uses a base plate manufactured by means of conventional subtraction. In the printer, the alignment of the base plate and the geometry to be printed is set up with the help of cameras integrated in the machine. If multiple base plates are set up, each component can even be individually aligned. Then the additive layering takes place. "Parts produced in this hybrid process can save enormous amounts of printing time and therefore printing costs, because the volume to be printed is greatly reduced. In the case of one of our first mold cores, the savings potential in terms of printing costs was around 42 percent", says Thomas Weinmann.

Thomas Weinmann and his team took a very close look at another important point in the layering on Preform: the complete material cohesion between the conventionally manufactured base plate and the printed part. We print on base plates made of 1.2343 ESR. Even under the microscope, no gaps, cracks or similar issues can be seen. That is, even in the hybrid process, the material is firmly bonded - we create one part," he explains.

Thanks to 3D printing, the conformal cooling required for the homogeneous and rapid removal of process heat is no longer an issue, as this technology can be used to realize previously unthinkable channel pathways that can be routed almost anywhere. Such mold cores would not be possible to implement conventionally. Often, it can even be used to produce molded plastic parts that could not be produced using conservative tool technology or could only be produced with a loss of quality.



Forecast

Thanks to the TruPrint 5000, H&B is able to meet its standards for quality and cost-effectiveness. CEO Hans Böhm: "An investment like this has to be carefully considered. But because we are very tech-savvy, it was easy for us. We see a tremendous opportunity in metal-based 3D printing. And in the beginning, it's really more about quality than cost." For him, the technology, and thus the TruPrint 5000, restructures everything, because tool steel is involved instead of regular metal. So the CEO simply finds it logical that tool and mold making via 3D printing will develop from an initial technological leap into a new mainstay for H&B Electronic in the near future. The first steps have been taken.

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