From technological leap to established mainstay

At H&B Electronic, an internationally recognized and certified manufacturer of high-precision components for electromechanics, industrial electronics, medical technology and other cutting-edge technologies, quality and cost-effectiveness go hand in hand. The family-owned company has made the decision to venture into the field of metal-based 3D printing, utilizing the TruPrint 5000 from TRUMPF. "We have very high demands as regards the quality and efficiency of our plastic components and thus our injection moulds. Which is why we are increasingly relying on the combination of near-contour tempering and the use of hot-work tool steel 1.2343. We can only meet these demands with the assistance of TRUMPF", says Thomas Weinmann, Additive Manufacturing Specialist at H&B Electronic.

H&B Electronic GmbH & Co.KG

www.h-und-b.de

H&B Electronic was established in 1984 as a manufacturing company specializing in electromechanical components. H&B develops and manufactures precision-engineered components, connector systems and assemblies on its 13,500 m² site in Deckenpfronn, situated on the edge of the Northern Black Forest – catering for customer-specific requirements with the utmost precision across all dimensions. For the past 30 years, this owner-managed company has set itself apart through its consistent and sustained growth.

INDUSTRY	NUMBER OF EMPLOYEES	LOCATION
Components for electromechanics, industrial electronics and medical technology	340	Deckenpfronn (Germany)

TRUMPF PRODUCTS

- TruPrint 5000

APPLICATIONS

- Metal-based 3D for injection molds

Challenges

At H&B, approximately 340 employees are engaged in the production of various items, including plastic housings for automation systems through injection molding. Among other considerations, the external appearance is also important. For instance, in an actuator-sensor box manufactured by H&B, diodes are positioned behind a transparent plastic window. In such scenarios, the tool requires numerous intricate cooling channels positioned near the contour to enable controlled, even dissipation of heat from the plastic during production, ensuring a rapid and uniform cooling process. This is because the specific type of plastic used in this application turns cloudy or milky if it cools down too slowly. In injection molding, the overarching principle for cooling is to keep it as rapid and uniform as achievable. Uniformity ensures quality, while swifter cycle times reduce costs per unit.

The company previously used the mold without temperature control related to the contour but faced issues such as cloudy windows and a high rate of rejected parts. While the tooling experts at H&B have been incorporating printed inserts with near-contour tempering into different tools for some time, they expressed dissatisfaction with the hot-work steels used in the L-PBF processes, particularly 1.2709. As a result, they opted to employ additive manufacturing with the well-known and popular hot-work tool steel 1.2343, a popular choice among toolmakers. Furthermore, they decided to carry out this process using their own 3D printer.

In comparison to the hot-work steel 1.2709, the quenched and tempered steel H11 (1.2343) has various advantages, such as improved wear resistance, thermal conductivity, hot hardness, temperature resistance and the ability to be polished. Its final material properties are fine-tuned through quenching and tempering, making it better suited for applications in mold making. However, due to its increased carbon content and the resulting poorer weldability, it places rigorous demands on the L-PBF process that is used.

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THOMAS WEINMANN

ADDITIVE PRODUCTION SPECIALIST AT
H&B ELECTRONIC

Solutions

This is where the TRUMPF TruPrint 5000 comes into its own – with a preheating capability of 500°C, it allows for the reliable processing of carbon-containing tool steels like 1.2343. The TruPrint 5000 heats the substrate plate to 500°C and maintains the plate and printed substrate at this temperature throughout the additive composition process. This prevents the solidifying material from dropping below temperatures at which hard, brittle martensite forms after the laser beam has melted the powder. Standard commercial printers with 200°C preheating are inadequate for maintaining such strict control of the temperature gradient. In the worst-case scenario, the result could be a part heavily marred by cracks, rendering it entirely unusable.

Thomas Weinmann is delighted with one of the added benefits: "Thanks to the additive composition, which includes the creation of a partial weld pool, repeated partial melting of underlying layers, and the layer-by-layer rotation of the laser paths, we achieve a fine-grained metal structure similar to the conventional variant of the tool steel made by electro-slag remelting (ESU)."

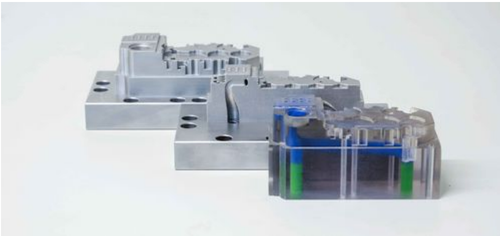
Implementation

Additive manufacturing begins where traditional subtractive manufacturing methods reach their limits. The Preform Basic option enables H&B to harness the benefits of both processes simultaneously. As an example, a tool core produced by H&B features tempering channel components in the lower section that extend vertically upward, and these can also be conventionally drilled in that region. However, the subsequent tempering channel part must be additively manufactured because it is not feasible to drill around the corner in this case.

To manufacture the tool core, H&B use a base plate that is manufactured using conventional subtractive methods. In the printer, the alignment of the base plate and the geometry to be printed is done using integrated cameras within the machine. If multiple base plates are prepared, each component can be individually aligned. Subsequently, the additive construction takes place. "Using hybrid parts manufactured like this can achieve a significant reduction in printing time and associated printing expenses, as the amount of material to be printed decreases significantly. One of our early tool cores achieved potential cost savings in terms of printing expenses of approximately 42%", explains Thomas Weinmann.

Thomas Weinmann and his team carefully examined another crucial aspect during the composition on Preform – ensuring the complete material continuity between the conventionally manufactured base plate and the printed part. "We print on base plates made of 1.2343 ESU. Even when viewed under a microscope, there are no visible gaps, cracks or any similar imperfections. So, in essence, we are absolutely achieving material hybridity – we're essentially creating a single part," he explains.

3D printing has eliminated the requirement for near-contour cooling, essential for homogeneous and rapid heat dissipation during the manufacturing process. This technology enables the creation of channel runs that were previously unimaginable, allowing for them to be routed almost anywhere. It would not be possible to manufacture tool cores like this using conventional methods. Frequently, it can even be applied to produce plastic molded components that would be impossible to manufacture with traditional tooling techniques or could only be produced with a compromise in quality.



Forecast

The TruPrint 5000 enables H&B to fulfil its quality and cost-efficiency requirements. CEO Hans Böhm explains, "You have to weigh up this kind of investment carefully. We are very tech-savvy, so it was easy for us. We see a huge opportunity in metal-based 3D printing. In the beginning, the focus is primarily on quality rather than costs." For Böhm, technology, and specifically the TruPrint 5000, revolutionizes the process, as it's not just about conventional metals but rather tool steel. It is only logical for a businessman to anticipate that 3D printing in tool and mold making at H&B Electronic will progress from an initial technological breakthrough into a new mainstay in the near future. The first steps have already been taken.

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