

# Case Report

## Conformal cooling using the example of a core for a die-casting mold insert

**FRECH**<sup>®</sup>



**3D printing in tool construction  
and die-casting**

Optimizing tool construction  
and die-casting processes at  
Oskar Frech

## COMPANY PROFILE

### Oskar Frech GmbH & Co. KG

Oskar Frech GmbH & Co. KG is a world market leader in die-casting machinery for both hot and cold chamber processes. The company currently employs around 800 people worldwide, with 430 employed in the company headquarters in Schorndorf-Weiler, Germany, with locations in Plüderhausen, Urbach and Velbert.

The company was founded in 1949 by Oskar Frech in Schorndorf near Stuttgart as a manufacturer of casting and injection molds. In 1965, the mechanical engineer Wolfgang Frech took over the company. A driving force of the company, Wolfgang Frech was responsible for the expansion of the product range to cold chamber die-casting machinery as well as the international focus of the company and its 20 subsidiaries.

Since then, Oskar Frech GmbH & Co. KG has distinguished itself through the highest quality and perfection in the production of die-casting machinery and tools. Wherever reliability and safety are a priority, the latest technology, the worldwide dedicated customer support and comprehensive service program guarantee customer satisfaction.

## CURRENT SITUATION / CHALLENGES

### Almost 70 years of experience from tool construction and pressure die-casting

10 years ago, Oskar Frech GmbH began industrial 3D printing. In 2007, Frech introduced the first FGS (Frech Gating System) distributors for branch gate die-casting. Without additive manufacturing technology, this FGS procedure would not be possible. The development of in-house additive technology was the next logical step, and subsequently a SLM®280 machine was procured at the end of 2015.

The main applications of additive procedures in die-casting at Oskar Frech are the already mentioned FGS distributors, prototypes and inserts for die-casting molds with the so-called **Conformal Cooling (CC)**.

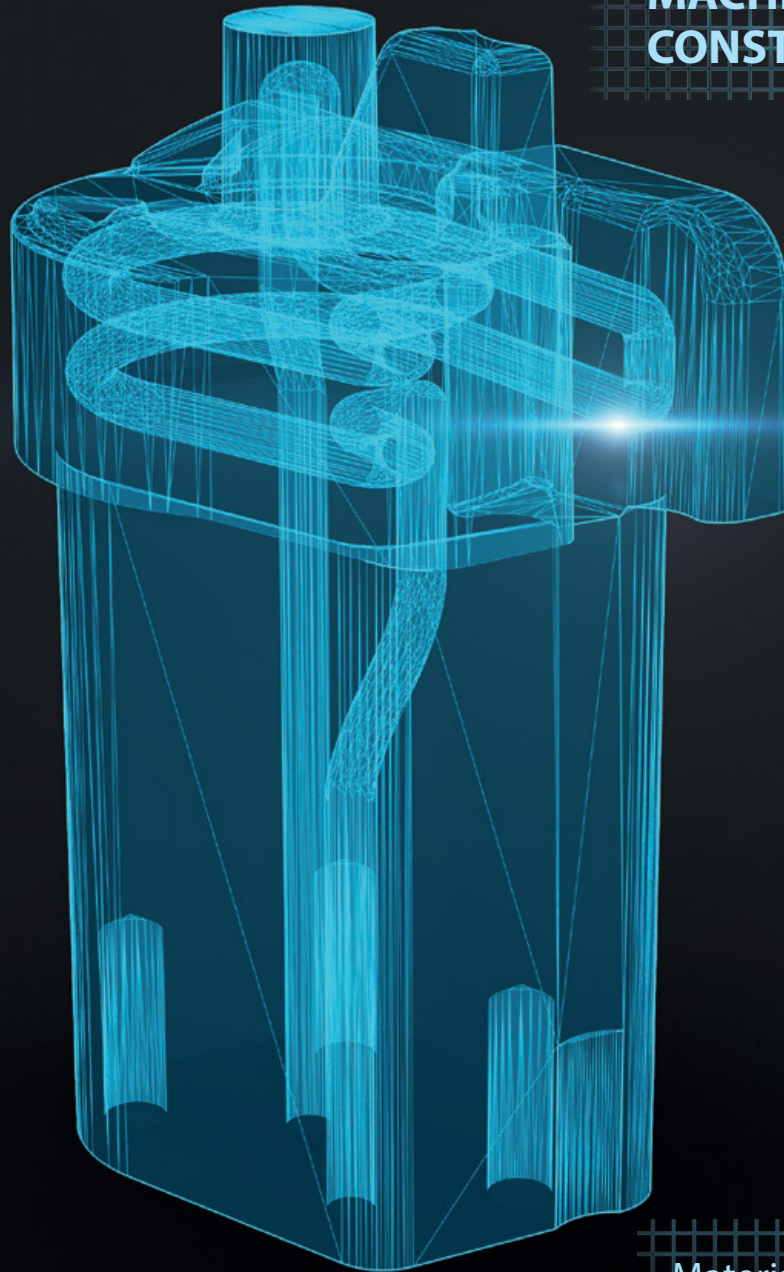
Through this method of tempering (heating and cooling), segments, i.e. cores and wipers, special channels inside the insert are produced with the help of this additive procedure. Their structure and form are optimally adapted to the geometry of the specific insert and its function in the die-casting mold. So that the tempering is efficient, the channels must be close to the surface (the contour) of the component.

Designation:

**CORE FOR A DIE-CASTING  
MOLD INSERT**

Industry:

**MACHINE  
CONSTRUCTION**



Manufactured on:

**SLM<sup>®</sup> 280**

Material:

**1.2709**



Thanks to years of experience in tool constructions, specialist expertise and an in-depth understanding of die-casting processes, FRECH is able to formulate the optimal design of CC to optimize thermal processes in die-casting, shorten the process cycle and improve the quality of the product.

## SLM® SOLUTION

# Conformal cooling for mold inserts

Oskar Frech currently processes two materials in the SLM®280 machine from SLM Solutions – aluminum alloy and tool steel 1.2709. Whilst the aluminum alloy is primarily used to produce prototypes, inserts for die-casting molds with special, complex channels for the conformal cooling are produced from the tool steel 1.2709. For the production of such complex internal tempering channels, generative manufacturing processes are used.

The conformal cooling for die-casting mold inserts creates new opportunities for efficient tempering of cores, wipers and even anvils. Thus, thanks to the conformal cooling designed by Oskar Frech, significant improvements regarding die-casting processes as well as the quality of the manufactured parts can be achieved:

- The shortening of the cooling time by around 60% from 12 to 5 seconds was achieved with the help of the cores, wipers and anvils used in CC
- Consequently, the total process cycle was shortened by more than 12%
- Manufactured parts do not exhibit any material defects
- Only isolated pores and small cavities arise in the parts

Alongside the increased profitability of the die-casting process and higher component quality, there are other advantages of CC such as optimizing the spraying process (“minimal spray”) and increasing the service life of the part.



Fig. 1  
SLM®280 at Oskar Frech

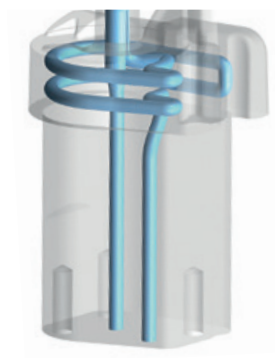


Fig. 2  
CAD file of a core with CC-channels inside the insert

## SUMMARY

# Conformal cooling using the example of a core for a die-casting mold insert

- World market leader in die-casting machinery for cold and hot chamber processes
- Highest quality and perfection in the production of die-casting machinery and tools
- Improvement of the surface structure of die-casting components through 3D-Printing
- Reduction of mold separating agent
- Shorter cycle times through shorter spraying and cooling
- Increasing mold service life



## About SLM Solutions

The Lübeck-based SLM Solutions Group AG is a leading provider of metal-based additive manufacturing technology. SLM Solutions focuses on the development, assembly and sale of machines and integrated system solutions in the field of selective laser melting.

SLM® technology offers diverse options in the metal-based additive manufacturing of parts, such as a new design and geometric freedom, lightweight construction through the reduction of metal part weight, significant advantages in terms of production speed and the manufacturing of internal undercut parts in low quantities.

Our products are utilized globally by customers from the most varied sectors, particularly in the aerospace, automotive, tooling, energy and healthcare industries, as well as in research and education.

They particularly value the following advantages of our technology partnership:

- Highest **productivity** using patented multi-laser technology
- Highest material density and **part quality** through our innovative gas stream management
- Completely closed **powder management** in an inert gas atmosphere
- Cutting-edge process monitoring using various **quality control modules**
- Multilingual open **software architecture** with customer adaptability
- Ultracompact **modular design**
- Long-term and **confidential customer relationships**
- **A technological leader and pioneer** in metal-based additive manufacturing with decades of market experience

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