SLM SOLUTIONS

Case Report
Additively Manufactured Lathe Tool

ARNO® WERKZEUGE

ROSSWAG engineering

World's first additively manufactured series turning tool for the cutting industry

3D-printing cooperation between ARNO-Werkzeuge and Rosswag Engineering

COMPANY PROFILE

Rosswag GmbH

With over 200 employees, the medium-sized, family-run company Rosswag GmbH is one of the world's leading providers of open die forging products of up to 4.5 t unit weight which are manufactured within the company using an integrated process chain. The in-depth knowledge of production and testing processes is reflected in the high quality of the end products which are used under great loads, for example, in the aerospace industry or in the power engineering sector.

The Rosswag Engineering division, which was established in 2014, supplements the product portfolio with engineering services and innovative production processes. The integration of the additive production process of selective laser melting enables the manufacture of function-optimized, metallic parts in addition to the forging operations. The expertise in the field of materials science and material technology, which has been acquired over decades, together with the integrated, company-internal process chain forms the basis for developing and expanding the future-oriented sector. The department for additive manufacturing, which is integrated within the company, was expanded in 2017 to include company-internal metal powder manufacturing for material development.

ARNO-Werkzeugbau

ARNO-Werkzeugbau is a manufacturer of high-quality cutting tools for turning, grooving, drilling and milling. The company's many years of experience in the sector of cutting technology, coupled with constant further development of existing tools – with simultaneous research into new materials – enables ARNO to present outstanding tools year after year. New materials require research and development as do the requirements for constantly increasing processing speeds. There is a need to improve and develop modular tool systems that can resist the forces present on cutting plates and tool holders.

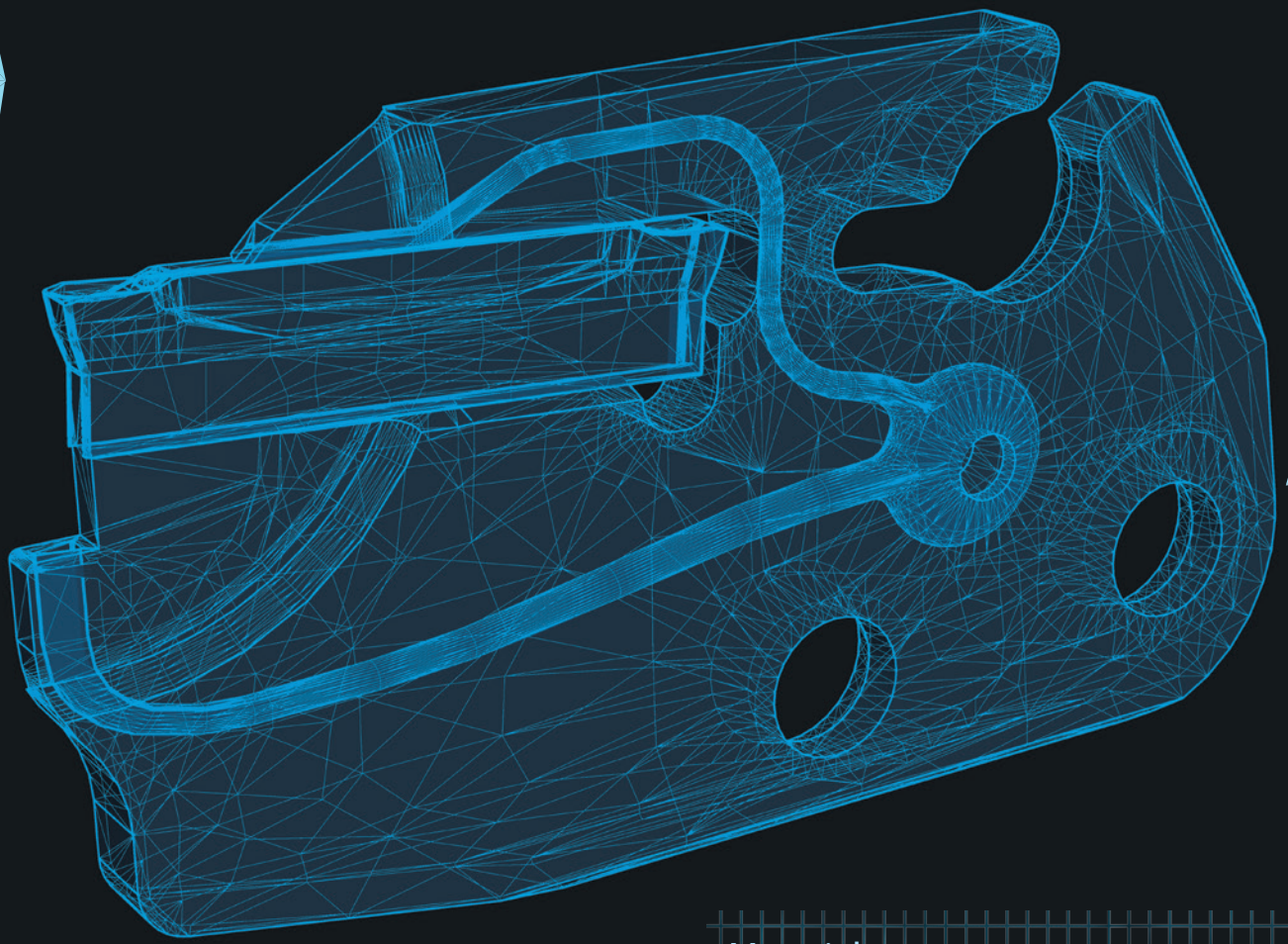
The use of "ARNO grooving modules" with the ARNO Cooling System (ACS) helps to reduce the on-going tool costs in the cutting process through an optimized coolant supply and to ensure a reliable cutting process.

Designation:

ADDITIVELY MANUFACTURED LATHE TOOL

Industry:

MACHINE TOOLS



Material:

MARAGING STEEL 1.2709

Produced on:

SLM®280 TWIN

CURRENT SITUATION / CHALLENGES

ARNO-Werkzeuge: Modern Cutting

The lathe tool is used for holding cutting tools and thus for the separation of workpieces on lathes. To manufacture a targeted cooling lubricant supply to the cutting insert, internal flow-optimized, nozzle-shaped channel structures are necessary with the required accuracies, diameter ranges and square outlet nozzles. Because these internal cooling channels cannot be created with conventional production processes the SLM® technology was used.

SLM® SOLUTION

SLM® Technology for the Manufacture of Cutting Tools

The ACS cooling system patented by ARNO, "Coolant under the swarf" with ACS2 has again been improved by means of a significant further development in connection with additive manufacturing technology. During cooling, the first jet of coolant specifically targets the cutting area while the second jet of coolant cools the free area of the insert from below. It was possible to manufacture the function-optimized design of the internal channel structures of the tooling insert with the help of SLM® technology in the "Additive Production" department of Rosswag Engineering.

The function-optimized design of the internal channel structures ensures an improved coolant supply to the cutting tool. This takes place, for example, through the use of nozzle-shaped and flow-optimized channel geometries with characteristic outlet nozzles. This counteracts the thermal expansion of the cutting tool and local overheating in the event of challenging cutting conditions is reduced. The service life of the cutting tool increases as the result of suitable process design. At the same time, it is possible to reduce the quantity of coolant used in comparison to flooding lubricant due to the targeted supply. In the cutting process, the targeted and optimized coolant supply also supports small chips, which leads to a reduction of process problems such as chip jams and ensures the reliable transportation of the chips away from the groove.

Fig. 1
With the ACS2, cutting and free areas are cooled

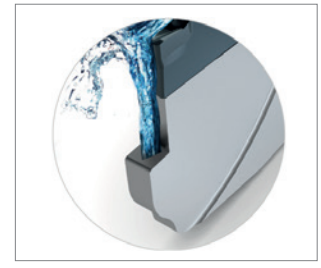


Fig. 2
Cooling channel meets the free area

The internal, flow-optimized, nozzle-shaped channel structures with the required accuracies and diameter ranges with square outlet nozzles can only be manufactured using the SLM® technology: the 30 mm x 60 mm x 3 mm part has been constructed on the SLM®280 at Rosswag GmbH, an exclusive partner of the SLM Solutions Group AG.

ARNO has already developed an ACS4 variant. This innovative solution for coolant supply to the main, free and minor free areas ensures a unique selling point for the effective cooling of the cutting tool from all sides.

Fig. 3
ACS4 Arno Cooling System (ACS4) with four outlet nozzles

SUMMARY

Additively Manufactured Lathe Tool

- Selective laser melting production of a function-optimized cutting tool with integrated channel structures
- Improved chip cutting and increased process safety due to optimized coolant supply
- Manufactured as series tool at Rosswag Engineering using SLM® technology and available from ARNO Werkzeuge via the warehouse
- Increased service life of cutting tools through innovative design with integrated internal features
- SLM® technology leads to innovative tool solutions for the cutting industry

About SLM Solutions

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.

The SLM® technology offers a variety of possibilities in the metal-based generative manufacture of parts, for example, new freedoms in design and geometries, lightweight constructions due to the reduction of the component weight, significant advantages in terms of production speed and the manufacture of internally undercut parts in low quantities.

Our products are used around the world by customers from the most varied of sectors, including in the aerospace, automotive, toolmaking, energy and healthcare industries, as well as in education and research.

They particularly value the following advantages of our technology partnership:

- Maximum **productivity** using patented multi-laser technology
- Maximum material density and **component quality** due to our innovative gas stream management
- Completely **closed powder management** in an inert gas atmosphere
- Cutting edge process monitoring using various **quality modules**
- Multilingual, open **software architecture** with customer adaptability
- Ultra compact, **modular construction**
- Long-term and **confidential customer relationships**
- **Technology leader and pioneer** with decades of market experience in metal-based additive manufacture

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