

Case Study

Single-Piece Extrusion Tool



**Generative manufacturing
processes at MonaLab GmbH**

3D-Printing Success Story



PROCESS OPTIMIZATION

reduced assembly manufactured in one piece

INCREASED QUALITY AND EFFICIENCY

thanks to features integrated with SLM® technology

Part data

Designation:	Single-Piece Extrusion Tool
Industry:	Tooling
Material:	AlSi10Mg
Layer Thickness:	30 µm
Build Time:	1d 6h (full load, 2 parts)
Machine:	SLM®280



SLM®280

Current Situation

More efficiency thanks to new solutions in additive manufacturing

Technical hoses are used in many different industries. The production takes place with the help of an extruder, in which material is transported by a screw conveyor through a cylinder. The material is heated to a homogeneous mass and pressed through the tool at the end of the extruder. After the melt has the desired shape, the material is cooled.

MonaLab GmbH has succeeded in producing the tool as a one-piece component with the aid of the SLM®

technology. In contrast to conventional methods, in which the tool has to be assembled from many small parts, additive manufacturing creates an integrated, reduced assembly design.

During the entire manufacturing process of the single-piece tool, the broad portfolio of SLM Solutions, consisting of machine, software and service, was available to support production and MonaLab.

Innovations with Selective Laser Melting

Multiple functions integrated into a single-piece tool

The integrated design of the tool, which is only possible with the aid of additive manufacturing, not only made the manufacturing process more efficient, but also significantly improved the tool's properties.

The extrusion tool, built in AlSi10Mg, is used to produce technical hoses with a diameter of 10 millimeters. The requirements of the component include substantial high-pressure durability for efficient production and a long tool life. Utilizing the benefits of selective laser melting, the tool integrates both flow-optimized construction and a reduced assembly, combining individual components into one. Static mixers that evenly distribute paint and additives, fins that rotate the melt, a thermocouple sensor mount and flange are integrated together, as well as an air feedthrough for the hose to prevent it from collapsing due to the surrounding pressure.



Fig. 1
Interior features built into one assembly within the extrusion tool

Designing the tool was one of the biggest challenges during the project because many individual parameters had to be considered. This succeeded with the open software architecture of SLM Solutions, which allows users the freedom to adjust all process parameters to optimize builds.

Based on the CAD data created, additive manufacturing could begin. MonaLab GmbH built the tool on the SLM®280, which is not only suitable for serial production, but also for the manufacture of individual components.



Fig. 2
Single-piece extrusion tool

Additive.Designer®

Additive.Designer® is a universal and flexible software tool for the additive manufacturing of complex components. It supports the user in positioning the component on the build plate and makes it possible to choose the orientation according to criteria such as surface quality, thermal stresses or with regard to the minimization of support structures. This results in significant material and cost savings and a significant increase in the quality of the manufactured components.

MonaLab GmbH implemented a customized strategy for the component and its high requirements with the help of Additive.Designer®. The ease of use of Additive.Designer® enabled fast implementation with high performance.



Fig. 3
Optimal component orientation with Additive.Designer® heatmaps

Summary

Single-Piece Extrusion Tool

- In the extrusion of technical hoses, the melt at the end of the extruder is pressed through the tool to create a homogeneous mass and shape, making internal features essential for quality of the final product.
- Production efficiency is considerably improved thanks to SLM® technology's ability to integrate internal features into a reduced assembly.
- The additively manufactured tool is produced in one piece, a design not possible with conventional production methods.
- The individual parameters of the component could be adjusted with SLM® open architecture systems and intuitive software.

MonaLab GmbH

MonaLab GmbH, a laboratory for additive manufacturing processes, is involved in the production and development of generatively manufactured components with the goal of becoming an established service provider for additively manufactured, modular key components in plastics and process technology. Components such as static mixers, heatsinks and tools or tool inserts with conformal cooling, as well as components for material handling are developed, manufactured and sold by MonaLab. The company was founded in 2017 by graduate engineer Johannes Frueh in Lauterach in Vorarlberg, Austria.

SLM Solutions - Technology Pioneers, Innovation Leaders

SLM Solutions helped invent the laser powder bed fusion process, was the first to offer multi-laser systems and all selective laser melting machines offer patented quality, safety and productivity features. Taking a vested interest in customers' long-term success in metal additive manufacturing, SLM Solutions' experts work with customers at each stage of the process to provide support and knowledge-sharing that elevate use of the technology and ensure customers' return on investment is maximized. Optimal paired with SLM Solutions' software, powder and quality assurance products, the SLM® technology opens new geometric freedoms that can enable lightweight construction, integrate internal cooling channels or decrease time to market.

A publicly traded company, SLM Solutions Group AG focuses only on metal additive manufacturing and is headquartered in Germany with offices in China, France, India, Italy, Russia, Singapore and the United States and a network of global sales partners.



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