

Case Study

Automotive Steering Knuckle



**Innovative solutions with
3D printing at Hirschvogel Tech Solutions**

3D-Printing Success Story

40% MATERIAL SAVINGS
compared to conventional forged part



LOW POST-PROCESSING EFFORT
due to less support structures

Part Data

Designation:	Car Steering Knuckle
Industry:	Automotive Industry
Material:	AlSi10Mg
Layer Thickness:	60 μ m
Build Time:	2d 7h 23min (full load, 1 piece)
Machine:	SLM [®] 500 Quad



SLM[®]500

Current Situation

Part development with a focus on the entire process chain

Development work at Hirschvogel Tech Solutions is always carried out based on an integrated approach, with a focus on the entire process chain. In this way, innovative and technically sophisticated solutions are commercially viable.

To gain maximum benefit from attractive solutions, including additive manufacturing, productive use of bionic methods is implemented, drawing on structures developed by nature over millions of years and applying them to the areas of engineering and technology.

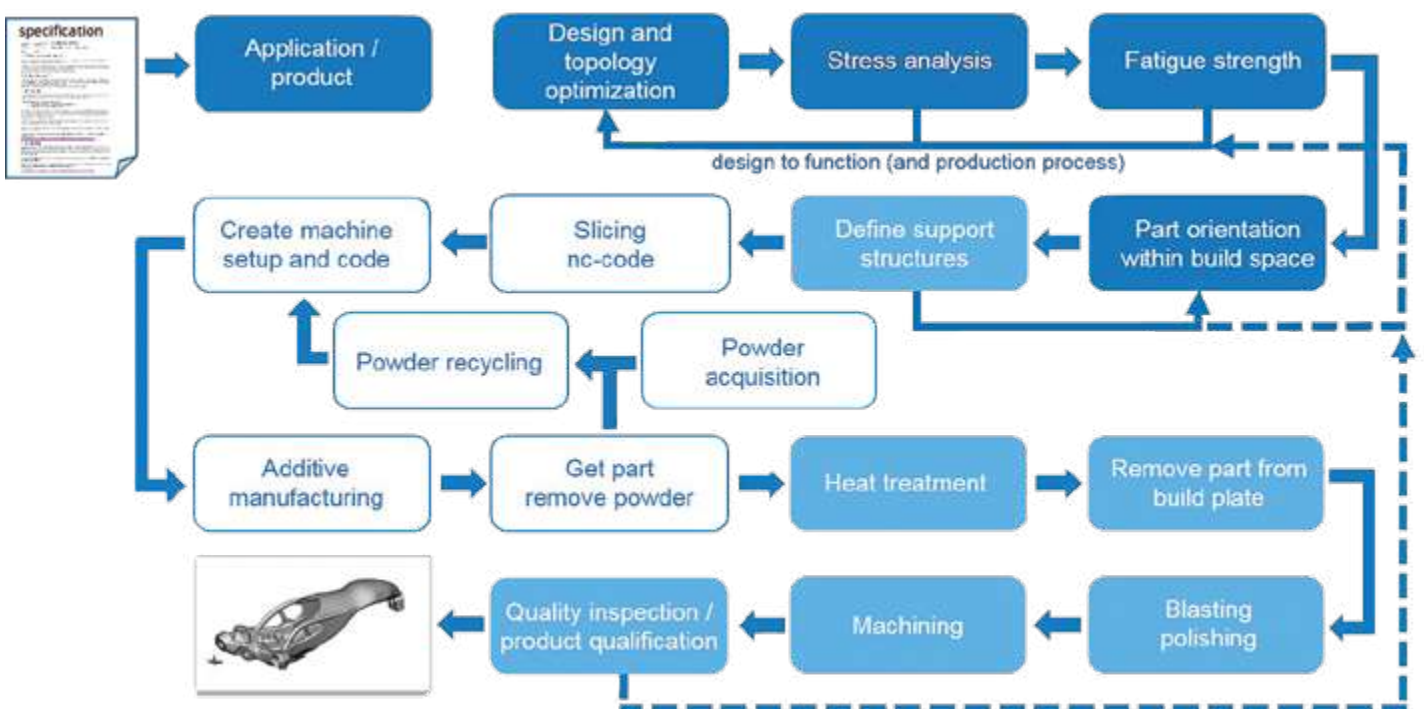


Fig. 1: Selection/assessment of design approaches

Innovations with Selective Laser Melting

Steering knuckle development

This approach was adopted on a steering knuckle, where it was possible to achieve a 40% weight saving in the neck area compared to the conventional forged part. All the requirements demanded of the part were fulfilled, taking into account the given assembly space. To do this, specially developed methods and specifically adapted CAx systems were used. Part design was carried out with a view to later production, allowing the part to be manufactured without the many additional internal support structures that would otherwise be required.

Initially, a number of part variants was developed based on solutions from nature. These variants were then assessed before selecting those which were calculated and verified to best fulfil the given boundary conditions.

The skillful positioning of the part, which is almost 600mm in length, means that it can be produced easily on an SLM®500 selective laser melting system. It was also possible to produce the part with minimized support structures, and completely without internal supports, resulting in low post-processing effort.

Tests carried out on tensile and notched bar specimens built in the same process showed results matching the forecast values.



Fig. 2:
Part structure with load-adapted supports

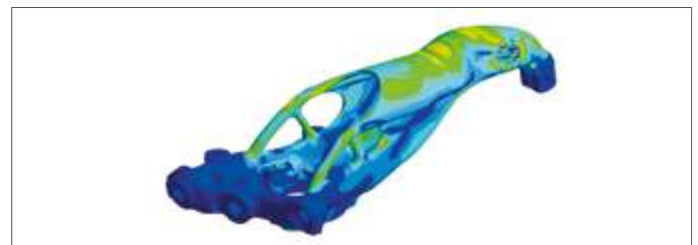


Fig. 3:
FEM calculation

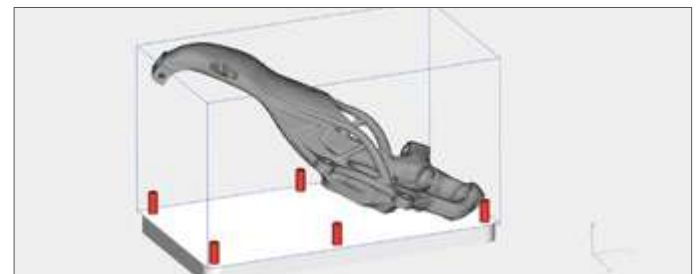


Fig. 4:
Precise build plate orientation

Hirschvogel Automotive Group

As a global automotive supplier with around 5,300 employees in nine plants on three continents, the Hirschvogel Automotive Group develops, produces and sells high-strength parts for the automotive industry, among others.

The vision of the company is to achieve continuous improvement and provide expert answers to the new questions arising from ever more stringent requirements. A corresponding level of commitment and passion goes into every product. As a creative development partner, the Hirschvogel Automotive Group draws on its development know-how to make an active contribution to achieving the technical and economic goals of its customers.

Summary

Automotive steering knuckle

- Global automotive supplier with longstanding experience in serial production
- Part development is based on an integrated approach taking the entire additive manufacturing process chain into account
- High level of development expertise in lightweighting, as well as in the application of designs based on bionics
- Material savings of 40 % compared to the conventional forged part
- Production requiring few support structures leads to reduced post-processing effort



Selection of the Part Spectrum of Hirschvogel Tech Solutions



Fig. 5:
Tong with structure adapted to the production process and loads



Fig. 6:
Spray nozzles



Fig. 7:
Tool with internal cooling



Fig. 8:
Housing



Hirschvogel Tech Solutions

As a brand of the Hirschvogel Automotive Group, Hirschvogel Tech Solutions is available as a competent service provider for part development and additive manufacturing. Through the combination of three service components – part development, additive manufacturing and materials/failure analysis – the company supports its customers with an optimum know-how package for developing innovative products and high-strength components. Hirschvogel Tech Solutions is an innovation partner and solution provider in many application areas that extend far beyond forging and the automotive industry.

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 exclusively 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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