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How 3D printing is revolutionizing investment casting

In lightweighting, hybrid combinations exist not only for materials, but also for process technologies. Schübel GmbH, for example, combines 3D printing of plastics with investment casting. Their AddCasting method offers an economical and comparatively fast way of manufacturing complex lightweight metal components that, due to their component geometry, can really only be produced using additive manufacturing technology.

The Development Agency for Lightweighting Baden-Württemberg presents this innovation in the January 2020 edition of the ThinKing. Leichtbau BW GmbH uses this label to showcase excellent lightweight technology products or services from Baden-Württemberg every month.

At a glance:

- ▼ **Combination** of 3D printing and investment casting
- ▼ **Complex (topology-optimized) geometries** possible
- ▼ **Faster than metal 3D printing** for large components
- ▼ **Suitable for series production** and cost-efficient
- ▼ Extremely high **surface quality**
- ▼ Shortened **time-to-market**, as there is no need for toolmaking

Lightweight components for the racing or aviation industry are optimized regarding their function and use. The possibilities of production engineering play virtually no role in component design during construction. Very often, this means that only additive manufacturing processes can be used. Christine Schübel, Managing Director of Schübel Primeparts, explains: “Geometries that can only be realized in 3D printing, but are too time-consuming and expensive for metal printing in series, can be **produced in an economical and comparatively fast way** using our AddCasting method. AddCasting combines the freedom of 3D printing with the technologically and economically advantageous investment casting process for metal components.”

The AddCasting method significantly expands the additive manufacturing possibilities for metal components in terms of available alloys, speed, economy and geometric degrees of freedom. The technological process of AddCasting was developed from scratch by Schübel Primeparts over a period of ten years and has been brought to series maturity in the last two years. According to Christine Schübel, it is suitable **for prototypes and small series of up to 500 units**. Typical examples include components for the aerospace industry, racing or mechanical engineering.

Instead of the wax pattern normally used in investment casting, the master models of the components are manufactured in plastic using 3D printing technology. Next, the surface of the model is refined using a special process. The optimized printed master model is then used in the investment casting process, instead of the wax pattern. The traditional investment casting process can be carried out without further modifications, meaning the metal parts produced in

AddCasting are approved for use and suitable for all areas. The innovative use of printed master models allows for optimal utilization of existing production capacities.

Design freedom for components produced by investment casting

Through the additively manufactured plastic master model, AddCasting can combine all the possibilities of additive manufacturing – topology optimization and complex geometries – with the technologically sophisticated process of investment casting. “In this combination, investment casting becomes an economically viable alternative to metal 3D printing – especially for topology- and function-optimized lightweight components. Even series of metal components with complex geometries – such as complicated undercuts and internal geometries – can be produced cost-effectively using this method,” says Christine Schübel.

The savings in time and costs are achieved through the elimination of the wax pattern tool. As the master model is additively manufactured from plastic, there is no need for a die, meaning that the AddCasting process usually **becomes more cost-effective than the conventional production method**, even for quantities of up to 500 units. Christine Schübel says that, depending on the component geometry, AddCasting can even be a faster and more cost-effective method than purely additive processes.

She goes on to say that – in addition to a significantly larger choice of materials for the cast component and a shorter lead time, especially for large components – it is a particularly significant step for lightweighting that “AddCasting opens up the possibility of manufacturing complex lightweight metal parts with a high degree of design freedom, using the proven investment casting process.” Christine Schübel is convinced that this technological process allows for new innovative constructions for lightweighting solutions. “There is a demand for implementations in AddCasting and it will open up new possibilities.”

After all, she knows from years of experience that “lightweighting can only be achieved successfully when there is a sustainable investment in the optimization of weight and function during the engineering process – regardless of the application. Everything must come under review.” And so, lightweighting begins with a clean slate, where everything is challenged: Not just the products, which should be optimized regarding their function and cost; but also the manufacturing processes – and it is here that the clever combination of manufacturing know-how plays a crucial role.

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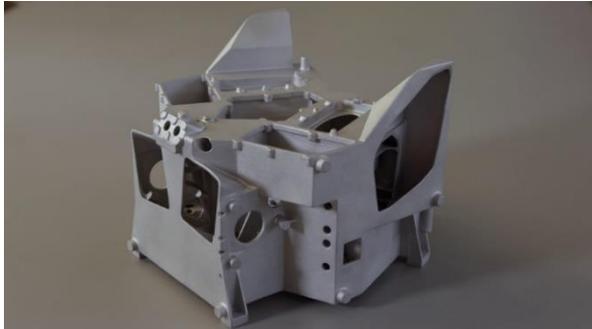
About Schübel GmbH

Schübel PrimeParts is a reliable partner for many companies requiring a lot size of one. As a Tier 1 supplier, the company produces exclusive small series of milled or cast aluminum components.

www.primeparts.de

Pictures

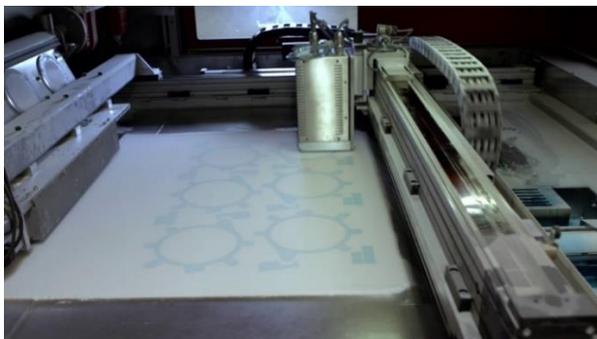
Schuebel1.jpg:



“Lightweighting can only be achieved successfully when there is a sustainable investment in the optimization of weight and function during construction,” says Christine Schübel.

The pictured component for a satellite was manufactured using the AddCasting method.

Schuebel2.jpg:



In AddCasting, the additive manufacturing process is used to create a master model made of plastic, allowing for casting of even highly complex geometries.

Schuebel3.jpg:



The 3D printed master model made of plastic maps out the contour of the future metal component inside the ceramic casting mold.

Source: Schübel GmbH. Reprint free of charge.

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