

Installation »LIGHT«

The installation consists of the word “LIGHT”, written in letters about two meters tall with a visible internal hollow structure. These were produced in Europe’s largest commercial workshop using stereolithographic techniques – Materialise, in Leuven, Belgium – and are unique in their size and design. The novel aspect of the letters is that they are composed of a complex yet airy lattice construction.

3D Printing: Lightweight Construction with Laser Technology

By spelling out the word “LIGHT”, this installation makes reference not only to optical technologies – a subject of special interest in this “International Year of Light” – but also to the “light” in “lightweight construction”, and thereby to additive laser manufacturing as used in 3D printing. Both of these represent core competencies of Fraunhofer ILT. The technique used to make the 3D printed plastic sculpture for the exhibition is essentially the same as that employed by Fraunhofer ILT when working with its industrial customers. Together, they design and manufacture metal components that are weight-optimized thanks to their internal structure. 3D printing makes it possible to produce customized parts and tools, including one-off designs, at an affordable cost. The tall letters serve as an impressive symbol of how lightweight such stable structures can be.

Individualization for free

Additive manufacturing technologies are the ideal solution for applications involving complex component geometries or requiring short response times, a high degree of customization, or the sparing use of raw materials. SLM is the 3D equivalent of the method used in laser printers, which deposit stored data on the paper as 2D characters or images. In SLM, a powdered metal or ceramic material is laid down in successive layers only a few micrometers thick on the basis of CAD data. Each layer of powder is melted using a high-power laser, gradually building up the desired 3D component or product. This method makes it possible to produce geometrically complex components while providing scope for customizing the final product according to customer requirements. The term used in this context is “individualization for free”, because the unit costs in SLM are independent of the geometrical complexity of the individual components. Each product is generated 1:1 from the calculated CAD data.

Complexity for free

Because there is no need for molds or forming tools to create the final, 3D product, the layer-by-layer SLM technique reduces the process to two dimensions. Manufacturing costs no longer depend on the geometrical complexity of the part but solely on its volume. In this respect, SLM offers numerous advantages compared to conventional methods such as forming and machining. It makes it possible to increase the complexity of a component, for instance by integrating specific functions or internal structures, without incurring additional costs. Hence the use of the phrase “complexity for free” when describing the ability of SLM to implement the topology-optimized and monolithic design of assemblies.

Weight reduction for free

The volume of the final component can be significantly reduced by integrating hollow spaces or lattice structures. For instance, metal chassis components constructed using hollow profiles are much lighter and stronger than components built by conventional methods. The mechanical properties of hollow profiles are calculated to bear just as heavy a load as conventional chassis components can. If these components are manufactured using SLM, every further optimization not only reduces weight but also cuts production time and costs – an advantage described as “weight reduction for free”.