



LOW-COST SLM SYSTEM

Task

As one of the additive manufacturing technologies, Selective Laser Melting (SLM) has established itself in the field of manufacturing technology since it can fabricate highly complex components made of metallic materials. Large companies are investing directly in the innovative technology to open up new sales markets or to improve existing products and processes. Small and medium-sized enterprises (SMEs) also increasingly see the economic and technological opportunities of additive manufacturing (AM), but they are often afraid of making the necessary investment. This is the issue the close-knit expert team of the Fraunhofer ILT and the FH Aachen University of Applied Sciences is addressing by setting up a low-cost SLM system. Since the partners have a practice-oriented approach and in-depth process and plant know-how, they can facilitate access to the additive manufacturing of metals, especially for SMEs.

Method

The idea behind the low-cost SLM system is to do without costly components, such as classical laser scanner systems. By using a Cartesian axis system in combination with a diode laser as a beam source, the partners have found the greatest potential for savings. The goal is to use the comparatively inexpensive plant design to help SMEs above all get started in the additive manufacturing of metals.

In a first step, a prototype plant was built with the following main components:

- 2-axis system
- Building space: Ø 80 mm x 90 mm
- Diode laser > 100 W with 250 µm focus diameter

Results

With this plant design, a diode laser was proven to be suitable for the selective laser melting of metal powder. In initial tests, parameters for material 1.4404 were validated, with which a density of over 99.7 percent was achieved. This results in a tensile strength corresponding to that of conventionally produced material. Demonstration models show how well the system functions and the geometrical component quality that can be achieved.

In a next step, the plant shall be adapted to industrial standards. This means continuing to develop the plant in the areas of control and software as well as integrating safety and protection functions. The parameterization of further materials, such as aluminum alloys and tool steels, will be at the forefront of process development. In addition, the building space will be enlarged in order to expand the fields in which the plant can be applied.

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2 Low-cost SLM system.

3 SLM process.