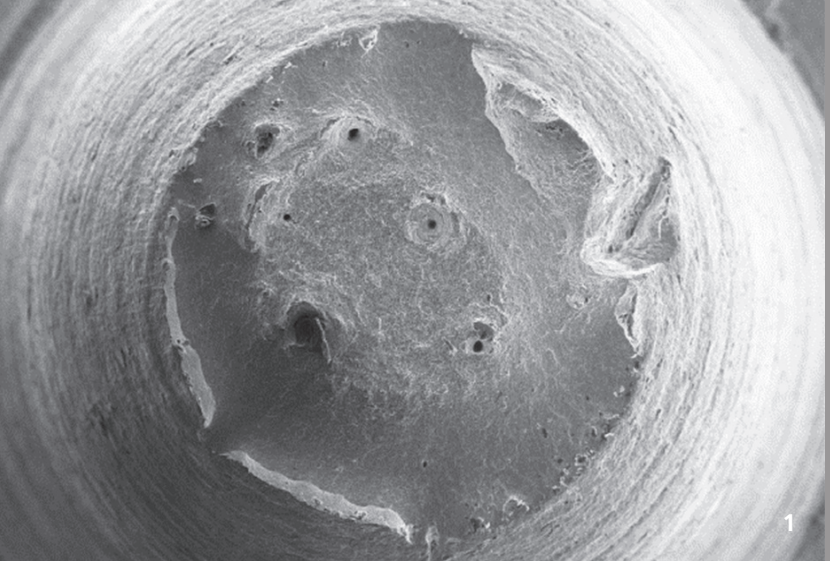

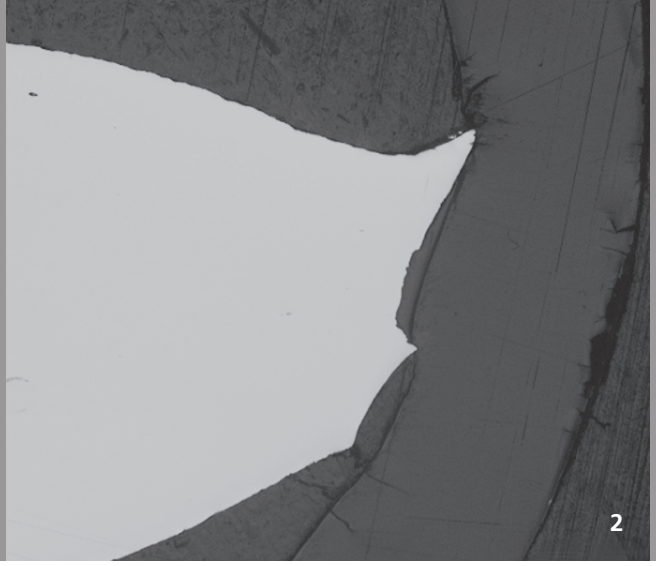

PROCESSING OF CASE-HARDENED AND HEAT-TREATED STEEL BY MEANS OF SLM

Task

Selective Laser Melting (SLM) belongs to additive manufacturing technologies and has established itself in manufacturing technology thanks to its ability to produce highly complex geometries made of metallic materials. To expand the possible applications of SLM, researchers are focusing their priorities on, among others, increasing the efficiency and extending the range of materials that this method can process. Materials previously utilized with SLM include case-hardened steel 16MnCr5 and heat-treated steel 42CrMo4, both of which are used mainly in the automotive and mechanical engineering sectors. These are considered, however, susceptible to cracking and, thus, difficult to weld. The aim of the project described here is to identify stable process parameters so that these materials can be processed as free of cracks and defects as possible. This way, the advantages of this manufacturing process – such as geometrical freedom and topology optimization – can be exploited optimally.

Method

Fraunhofer ILT has examined the extent to which these two materials can be processed. To this end, it initially adapted the process-related parameters to a pre-heating strategy. The preheating system integrated in the plant engineering makes it possible to strongly reduce thermal gradients and stresses by preheating the materials to a temperature of about 500 °C. In a second step, the resulting structure will be investigated and the mechanical properties determined in a tensile test.

Result

Successful trials have demonstrated that the materials 16MnCr5 and 42CrMo4 can be processed free of defects on a laboratory scale. The adjustments to the process parameters allow a crack-free structure of specimens with a density of nearly 100 percent.

In further steps, suitable heat treatment will be determined and the preheating temperature reduced so as to transfer the parameters to conventional plants.

Applications

Thanks to the advantages of topology optimization and function integration, the process can be applied especially in the automotive and mechanical engineering sectors. Possible applications include the processing of transmission components, gears and camshafts.

Contacts

Dawid Ziebura M.Eng.
Telephone +49 241 8906-8172
dawid.ziebura@ilt.fraunhofer.de

Dr. Wilhelm Meiners
Telephone +49 241 8906-301
wilhelm.meiners@ilt.fraunhofer.de

1 Fracture point of a tensile specimen out of 16MnCr5.

2 Micrograph of a tensile specimen out of 16MnCr5.