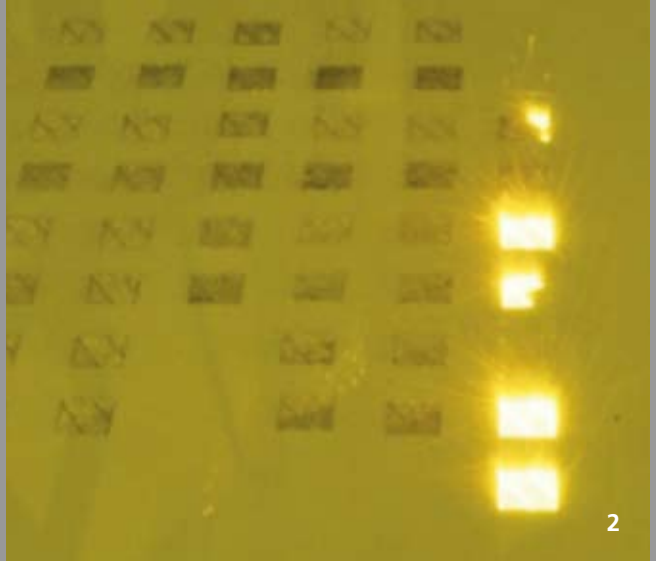

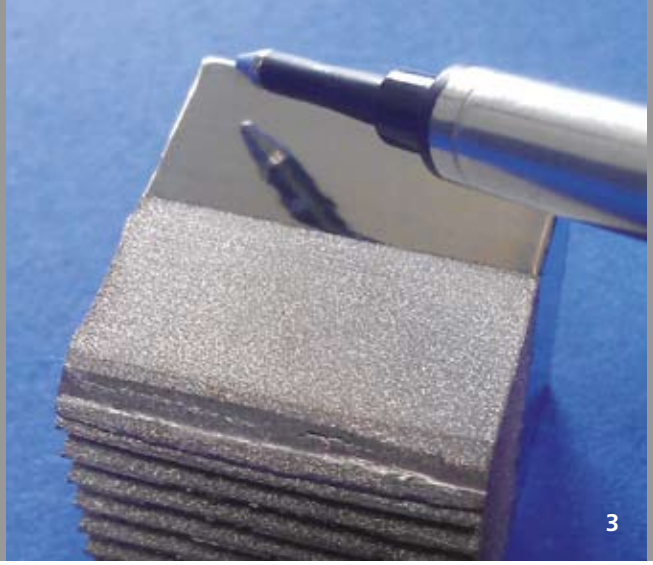

LASER POLISHING OF SLM COMPONENTS OUT OF INCONEL 718

Task

Thanks to its nearly unlimited geometrical degree of freedom, the additive manufacturing process Selective Laser Melting (SLM) makes it possible to produce complex and unique components out of series-identical working materials. Since this process generates components layer-by-layer out of powdered material, however, they exhibit a large surface roughness (R_a of approx. 20 µm) in comparison to those finished by machining processes. According to current state-of-the-art, post-processing – e.g. machining the functional surfaces – is, therefore, necessary to improve the component's surface quality.

Method

Within the scope of the European research project »AMAZE«, Fraunhofer ILT has developed the application of the laser polishing process for the post-processing of components made out of the nickel-based alloy Inconel 718 by SLM. The laser polishing is based on the melting of a thin upper layer and the smoothening of the surface on account of interfacial tension. In comparison to conventional grinding and polishing processes, no material is ablated in SLM, but rather solely remelted. Using this fundamentally different active principle of laser polishing in combination with automation of the process, the project aims to reduce costs with respect to the time- and, thus, cost-intensive conventional surface processing of a component's functional surfaces.

Result

The surface roughness of a cubic sample produced by SLM could be reduced from R_a = 20 µm to R_a = 0.19 µm. The surface processing rate during laser polishing is 2.25 cm²/min. These results, gained from initial parameter studies, are promising and form the foundation for further developments of the process combination of SLM and laser polishing for complex free-from surfaces.

Applications

Due to their strength at high temperatures, components made out of Inconel 718 with free-form surfaces by SLM are used in the aerospace industry as well as for turbine construction.

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2 Picture of the Selective Laser Melting (SLM) process.
3 Laser polished surface of an SLM sample out of Inconel 718.