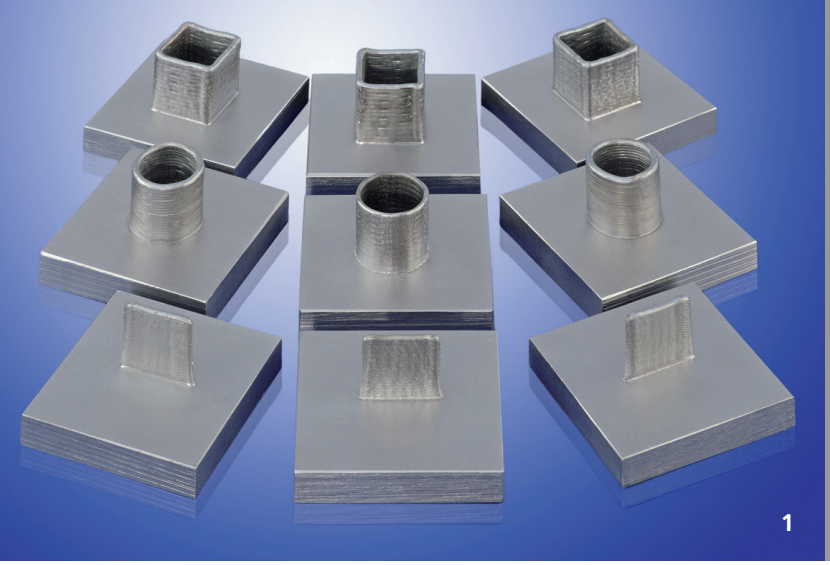

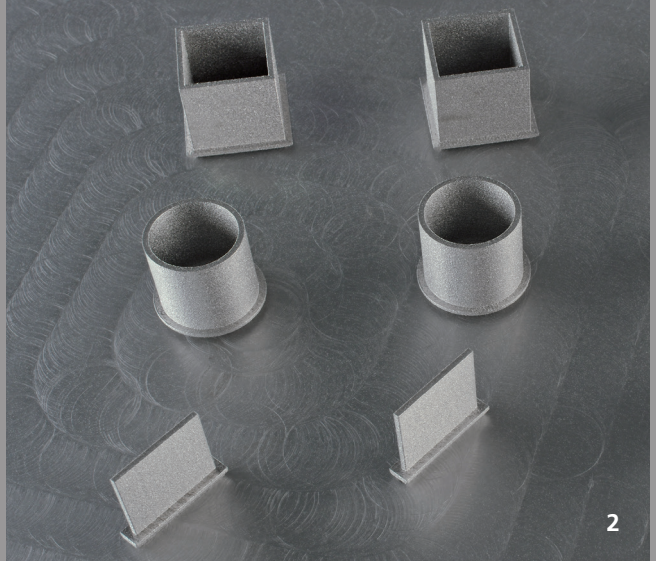

COMPARISON OF ADDITIVE MANUFACTURING TECHNOLOGIES SLM AND LMD

Task

Selective Laser Melting (SLM) and Laser Metal Deposition (LMD) are the most important procedures in the field of laser-based additive manufacturing with metallic materials. The two methods differ with regard to their inherent properties. These involve differences in the component properties (e.g. geometric fidelity) that can be attained and that have a direct impact on an application-specific method qualification. Within the Fraunhofer Innovation Cluster AdaM, Fraunhofer ILT aims to compare the processes in order to develop a basis for deciding on the appropriate method specific to a particular application.

Method

The comparison of the methods SLM and LMD involves three categories. These are the geometric properties attainable, the mechanical properties under static load and the microstructure of the material. The material used was Inconel 718 (grain fraction 15 - 45 µm). The comparison of these geometric properties was based on five test geometric structures (hollow square, hollow cylinder, full-square, solid cylinder and vertical tab). For statistical purposes, each test geometrical structure was built four times for each process and parameter set, and measured both tactilely and visually. The wall thicknesses obtained in the test structures were measured with micro-structural cross sections.

Result

The test geometric structures were produced with both methods. For all of them, the smallest deviations in shape (< 50 µm) were attained by the SLM process with a beam diameter $d_{Laser} \approx 100$ µm. The lowest surface roughness was exhibited with the LMD process, which used beam diameters of $d_{Laser} \approx 1300$ µm and $d_{Laser} \approx 2000$ µm (R_a approx. 6 µm).

Applications

The current investigations for Inconel 718 are primarily directed at applications in turbomachinery; however, the findings here (e.g. determining the geometric properties) can also be used in other fields.

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Contacts

Dipl.-Ing. Moritz Alkhayat
Telephone +49 241 8906-445
moritz.alkhayat@ilt.fraunhofer.de

Dr. Andres Gasser
Telephone +49 241 8906-209
andres.gasser@ilt.fraunhofer.de

1 Test geometric structure produced with LMD.

2 Test geometric structure produced with SLM.