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ADDITIVE MANUFACTURING OF SATELLITE COMPONENTS

Task

Given their favourable weight/strength ratio, aluminum components are used in many areas of industrial production. For satellite antenna components this property, together with good electrical and thermal conductivity, is particularly important because the cost of transporting satellites into space is largely determined by their weight. As a rule, components for satellite antennas are hollow bodies. The actual functional geometry which is needed to conduct electromagnetic waves is restricted in many components to a thin-walled hollow profile (wall thicknesses < 1 mm). Up to now, antenna components have been produced by means of conventional techniques such as milling and eroding. The components are made of several parts which have to be assembled by means of screw connections. As a result, components cannot be consistently designed and produced to achieve optimum function and weight. Additive manufacturing by Selective Laser Melting (SLM) avoids these deficiencies because it enables components of virtually any complex structure to be produced without having to use shaping tools. The aim is to develop the SLM process for the production of aluminum components exhibiting high surface quality and shape accuracy so that SLM can be used for antenna components.

Results and Applications

Initial tests conducted to determine the suitability of SLM for the production of antenna components made of aluminum yielded promising results. The coupler shown in Fig. 2 was produced by means of SLM. The weight of the component has been reduced by approx. 40 percent compared with the conventional version (Fig. 1). Owing to the current surface roughness ($R_z \sim 50 \mu\text{m}$), the components up to now exhibit generally poorer HF properties than comparable milled components. Further work will focus on improving the surface finish and dimensional accuracy by using a new laser beam source of high power and brilliant beam quality. In future the intention is to design function- and weight-optimized satellite antennas without having to allow for the restrictions of current production techniques and to manufacture them quickly, cost-efficiently and with minimum waste.

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- 1 Conventionally produced coupler with screw connections.
2 Weight-optimized coupler produced by SLM (left),
cross-section (right).