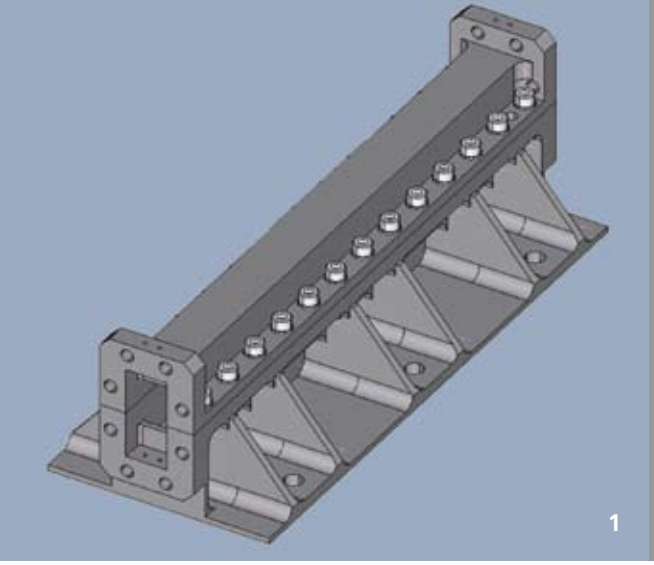

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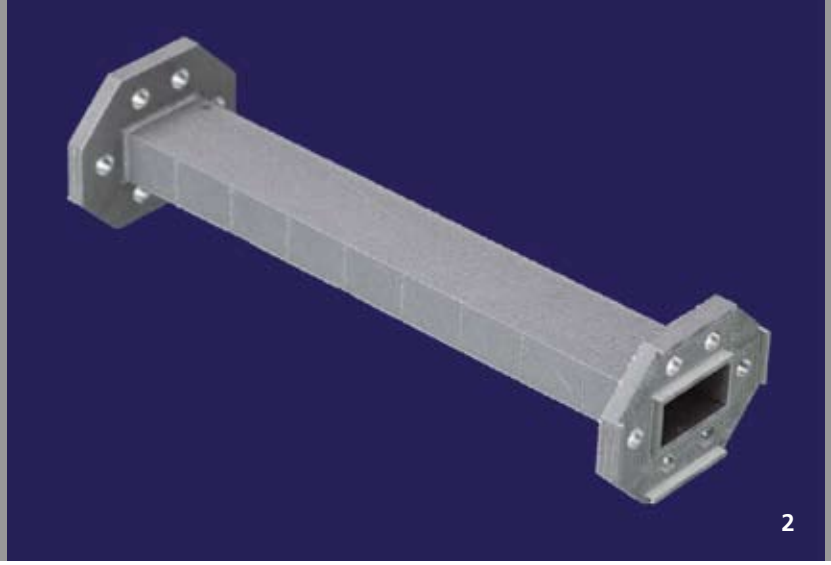

2

MANUFACTURING ANTENNA COMPONENTS FOR SATELLITES OUT OF ALSI10MG WITH SLM

Task

Aluminum wave guides are utilized in satellite antennae due to their favorable strength-to-weight ratio along with their good electrical and thermal properties. Indeed, the costs for transporting the satellite into space depend decisively upon its weight. A waveguide's actual functional geometry, which is needed to conduct the electromagnetic waves, is normally confined to a thin-walled (< 1 mm) hollow profile. Nonetheless, manufactured components have often massive bonding structures, necessary solely because the currently available manufacturing techniques do not allow monolithic manufacture. When SLM is used to produce this wave guide geometry, bonding elements are not needed, thereby reducing the weight while simultaneously retaining the roughness, dimensional and shape accuracy as well as the electrical characteristic values.

Method

Basic investigations were conducted regarding the surface quality, shape and dimensional accuracy and the connection between roughness and electrical values of the waveguide components. The processing of AlSi10Mg in SLM processes at high power (up to 1 kW) and high speed (up to 5,000 mm/s) were investigated for the first time. In this process, all the steps of the SLM process for AlSi10Mg were studied, beginning with the single tracks up to complex components.

1 Conventionally manufactured waveguide (source TESAT).

2 Waveguide manufactured with SLM.

In addition, examinations were made on the shape and dimensional accuracy and their dependence upon a preheating temperature as well as investigations of different construction strategies (e.g. component orientation) of diverse lightweight geometrical shapes.

Result

A lightweight geometrical shape was produced by means of SLM, which reduced the weight of the waveguide by up to 60 percent as compared to the conventionally manufactured shape. The surface roughness currently possible with SLM is, however, coarser than the roughness attainable with the conventional process. It could be shown, however, that the roughness is not a gauge for electrical characteristic values as previously assumed since these values of the waveguides produced conventionally and with SLM are largely identical.

Applications

SLM can be used for manufacturing short connection pieces in the highly demanding Ka band. The insufficient shape accuracy currently limits the wider usage in satellite technology.

The work was conducted using devices and plants that were funded by the State of North-Rhine Westphalia and the European Union's European Regional Development Fund EFRE (»Regionale Wettbewerbsfähigkeit und Beschäftigung 2007-2013«) under the grant number 290047022. The work presented here was conducted in the project »GenSat« funded by the Federal Ministry of Education and Research.

Contact

Dipl.-Phys. Andrei Diatlov
Telephone+49 241 8906-608
andrei.diatlov@ilt.fraunhofer.de

Fraunhofer Institute for Laser Technology ILT, www.ilt.fraunhofer.de
DQS certified by DIN EN ISO 9001, Reg.-No.: DE-69572-01