



PRECISION WELDING OF SENSOR SUPPORTS IN THE AEROSPACE INDUSTRY

Task

The space probe Solar Orbiter will examine the interaction between the sun and heliosphere. One of the sensors on board of the satellite is called STIX, which is responsible for the imaging spectroscopy of thermal and non-thermal X-rays of the sun. For this sensor, a support tube had to be fabricated and capable of withstanding the mechanical and thermal loads in transport and operation.

Method

Starting from a base construction made of aluminum, Fraunhofer ILT searched for a more rigid, thermally stable and lighter construction. To accomplish this, a tailored welding process including the heat treatment and surface treatment was developed. The production was divided into a development and a production phase. The overall project will be documented according to the guidelines of the ESA.

Result

Given the high loads, the original design out of an aluminum alloy was rejected and replaced by a structure of high-strength titanium. Due to the high strength, the wall thickness could be reduced, so that the new component has a weight of only one ninth compared to the original design.

Allowing for the small wall thicknesses of 0.5 and 1 mm with high manufacturing precision, a special device concept has been developed, making it possible to laser weld with an integrated shielding gas guide. Process, machine and welding were inspected and approved according to the rules of the ESA.

After welding, the component was subjected to a heat treatment for stress-relief annealing so that it would comply with the tight tolerances concerning dimensional and shape accuracy. Thermal and mechanical properties, as well as the surface resistance, were improved by anodizing.

Applications

The development described here is a classic single-piece production process for space travel applications. It could be shown that this process makes it possible to produce other components for instruments and support structures under industry-specific requirements. For terrestrial applications, information was gained on material behavior, especially for welding thin-walled titanium pipes. Here, fields of application are, in particular, apparatus engineering and the design of centrifuges, where new potential solutions have been developed.

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1 View of the support from the lens terminal.