



ASSEMBLY TECHNOLOGY FOR COMPACT OPTO-MECHANICAL COMPONENT GROUPS

Task

New soldering technologies can be used to build robust optical components and systems that are outgassing-free and stable for the long-term. The project described here aims to join materials – without using flux – that are difficult to wet without a mediator layer so that work steps such as the metallization of components are no longer necessary. This technology can also be used in ambient air, and thanks to this, both equipment and work steps are no longer needed for creating an inert gas atmosphere, as is the case with classic soldering technology. To be developed is an assembly technology that can be used for the construction of compact laser beam sources.

Method

The assembly technology was used to build a solid-state laser developed at Fraunhofer ILT. All of the optical components were assembled using the above-mentioned soldering technology. Especially developed for the alignment of opto-mechanical components in the aerospace industry, the pick & align technology was used to align components actively. Thanks to the inductive heat supply and different soldering systems, optical components can be individually mounted and adjusted in limited space. The use of soft solders is advantageous for reducing thermally induced stresses.

Results

A fully functional laser beam source has been constructed using the soldering technology developed at Fraunhofer ILT. The same performance is achieved as with classical optics holders. Since the interfaces have high thermal conductivity, the heat can be optimally dissipated from the system, in contrast to conventional mounting methods, so that a rapid thermalization of the laser was achieved. The dimensions of the mounted laser beam source are 153 x 40 x 20 mm³. The mechanical strength of the soldered joints has been proven by tensile tests. The assembly will soon be subjected to temperature cycle, vibration and shock tests.

Applications

The innovative concept makes the assembly process more economical and efficient. The developed assembly technology enables the construction of compact, robust and long-term stable laser beam sources. These can be used, for example, to mark and label, in metrology and medical technology as well as for miniaturized, complex systems in quantum technologies. The assembly concept opens up a wide range of applications in industry and research.

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1 General view of the laser system.