



## MECHANICALLY AND THERMALLY STABLE MICRO-OPTICS ASSEMBLY USING SOLDERING TECHNIQUES

### Task

Stable high precision joining techniques for assembling micro-optics are a prerequisite whenever diode laser modules are to be used under extreme environmental conditions with large mechanical and thermal loads. Consequently, the research will focus on assembling the FAC (Fast Axis Collimation) lens for diode laser bars using resistance soldering techniques. In addition to modifying the soldering technology developed at Fraunhofer ILT, a particular focus lies on assembly accuracy and the behavior of the FAC lens during the thermal alternating load cycle from -30 °C to +50 °C.

### Method

The soldering technology used to assemble the FAC lenses needs to be modified for the tests that will be conducted on account of the use of conventional laser bars, heat sinks and FAC lenses. To this end, the peripheral equipment and the processes are being modified so that soldering can be completed in a vertical position. The ceramic required for the resistance soldering is applied on the heat sink. The FAC lens is then actively aligned on top of the ceramic and soldered. The beam

properties (size and position of the emitters) are determined using a camera. If the deviation of the spot size exceeds the preset tolerance (> 10 percent) after the solder hardens, the join can be melted and the lens readjusted.

### Result

The assembly technology for FAC lenses developed at Fraunhofer ILT guarantees a thermomechanically stable join. The modification of the beam properties through hardening of the solder is around 1 percent. The thermal alternating load cycles were successfully completed.

### Applications

The process described for assembling FAC lenses is suitable for use in optical systems for aerospace applications, for pumping of solid state lasers, in medical technology and direct materials processing. The technology also boasts major potential regarding automated assembly.

### Contacts

Dipl.-Ing. Heinrich Faidel  
Phone +49 241 8906-592  
heinrich.faidel@ilt.fraunhofer.de

Dipl.-Ing. Michael Leers  
Phone +49 241 8906-343  
michael.leers@ilt.fraunhofer.de

- 1 FAC lens assembled in front of the diode laser bar (experimental setup).
- 2 Camera image of the emitters following the temperature cycle test.