



PACKAGING OF LASER CRYSTALS

Task

Thanks to the steady development of solid-state lasers, the packaging of the individual components has to face ever new challenges. Laser crystals of different shapes and materials need to be fixed in a robust, tension-free and thermally stable manner.

Method

To connect laser crystals with specially adapted heat sinks, reflow soldering techniques established at Fraunhofer ILT are increasingly being used. Solder layers produced by PVD (physical vapor deposition) are used to bind the crystals with low thermal resistance and without tension. For particularly large dimensions, adapted soldering parameters – such as soaking times as well as heating and cooling rates – must initially be calculated.

Result

The reflow soldering technique is suitable for special bar-shaped or rectangular geometries, in addition to typical laser crystals (e.g. Nd:YAG, 5 mm x 5 mm x 10 mm). For example, Nd:YAG crystals having dimensions of 45 mm x 40 mm x 9 mm could be soldered. Measurements in the polarization meter showed negligible tensions in the interior of the crystal.

Applications

As part of the »Nirli« project (»NIR Laser Beam Source of High Pulse Energy as a Technology Demonstrator Model and LIDT Test Source«), a demonstrator model was built having two INNOSLAB amplifier stages. In the two-stage arrangement, the model generated slab pulse energies that have more than 500 mJ at a repetition rate of 100 Hz and at near-diffraction-limited beam quality.

The soldering process can be adapted to different crystal materials and geometries and applied especially in lasers of high average output power. The soldering process can be applied to other components such as mirrors, lenses or also nonlinear crystals.

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1 Soldered laser crystal.