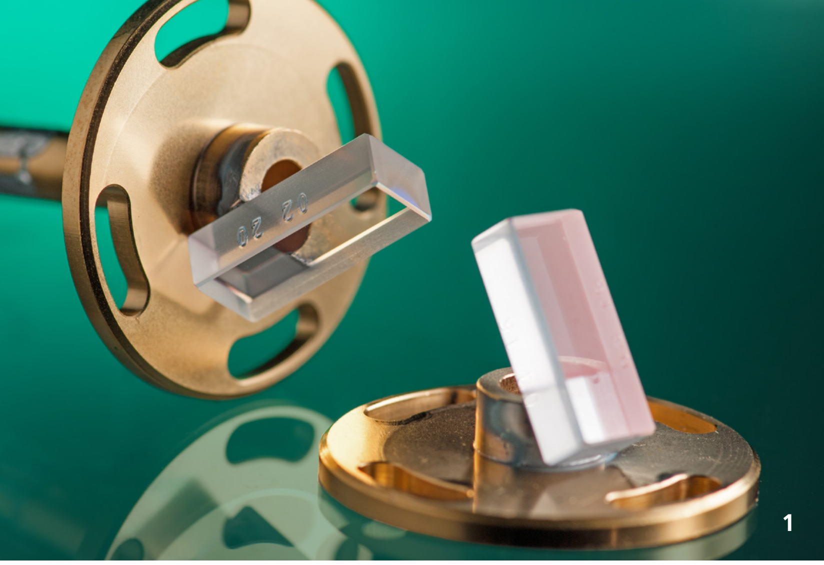

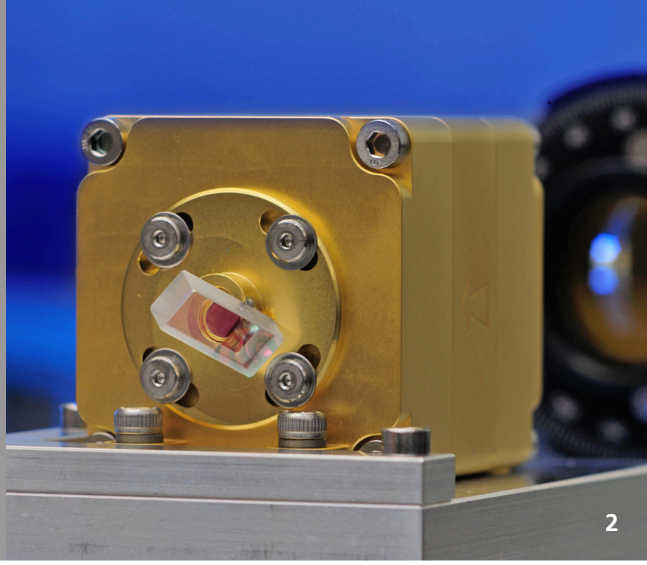

Subject to alterations in specifications and other technical information. 06/2016.

FARADAY ISOLATOR FOR SPACE MISSIONS

Task

Laser systems deployed on satellites (e.g. in the field of atmospheric research) require optic components that are mechanically and thermally stable as well as free of emissions. The installation of TGG crystals in Faraday isolators is challenging due to mechanical stresses and resulting birefringence. Commercially available isolators are inappropriate due to low stability and poor outgassing behavior. For this reason, a soldering process is needed for the assembly of the TGG crystals. Before these crystals can be used in space, however, tests must prove that the components are suitable for use under the appropriate environmental conditions (vibrations of 4 g_{rms}, alternating thermal loads from -30 °C to +50 °C).

Method

A TGG crystal is soldered in a holder made of aluminum. In order to reduce the mechanical stresses in the crystal, a soft solder is used. Furthermore, the stresses are reduced by the geometry of the solder joint. In the same assembly step, a polarizer is soldered to the crystal holder. Subsequently, a second polarizer is mounted on the counterpart of the holder, also by means of solder. After that, the crystal holder and its counterpart can be placed in the adhesive-free magnetic field. The polarizers can be adjusted – to maximum isolation, or maximum transmission – via a screw connection.

Result

The isolators achieve a degree of isolation of more than 34 dB and an insertion loss of less than 0.2 dB. Environmental tests on individual specimens do not show any changes. The soldered crystals have smaller mechanical stresses than do the bonded assemblies. To determine the potential of this soldering technology, however, long-term investigations will take place in a next step.

Applications

The Faraday isolators constructed using the method described here are suitable for, in addition to space applications, industrial solid-state laser systems in particular, where outgassing and laser-induced contamination play an important role. This is especially true for ultrashort pulsed and UV lasers.

Parts of the work were carried out within the R&D project »OPTOMECH III« on behalf of the Federal Ministry for Economic Affairs and Energy under grant number 50EE1235.

Contacts

Dr. Heinrich Faidel
Telephone +49 241 8906-592
heinrich.faidel@ilt.fraunhofer.de

Dr. Jens Löhring
Telephone +49 241 8906-673
jens.loehring@ilt.fraunhofer.de

1 Soldered optics of the Faraday isolator.

2 Faraday isolator in the measurement setup.