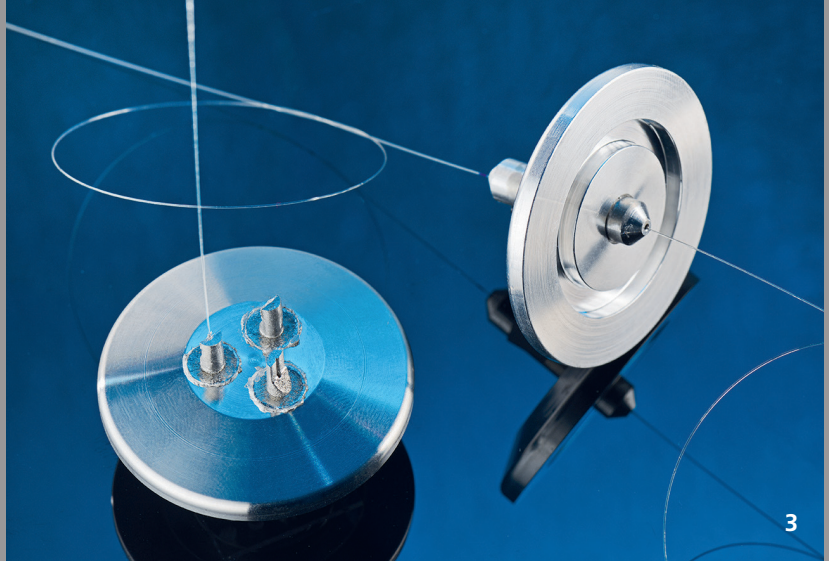

DEVELOPMENT OF A HERMETICALLY SEALED, SOLDERED FIBER GUIDE

Task

Optical glass fibers for guiding laser radiation require interfaces that are usually implemented in the form of fiber plugs and guides. In special applications, e.g. in high-power electronics, special measuring systems and space technology, the optical system is located in a vacuum or in an inert gas environment so that each external interface must be sealed in a vacuum-tight manner. The fiber guides used for this purpose should sufficiently hermetically seal the optical system to prevent contamination. The assembly procedure must not affect the optical properties of the fiber. For this reason, a vacuum-tight fiber guide should be developed using soldering technology.

Method

The fiber is mounted in a fiber guide specially designed for soldering and hermetic sealing. With suitable solders, fibers can be mounted on metallic and non-metallic substrates under ambient conditions. First, a process is used to wet the fiber and the fiber guide with the solder. The wetting process does not require an intermediate layer as a metallization. The use of soft solders is advantageous for reducing thermally induced stresses.

Results

Optical measurements show that the soldering technology for polarization-maintaining fibers has a marginal influence on the beam properties after the fiber. Since the fiber is mounted without fiber connectors, there is also no loss of power at this point. The tightness of the fiber guide was determined with a pressure rise test, and a leakage rate of $Q \leq 1.15\ 10^{-6}$ $mbar*l*s^{-1}$ was proven. Due to the high thermal conductivity of the interface, higher optical power can be transmitted, which is in contrast to conventional assembly methods. The mechanical strength of the soldered joints was verified by tensile tests.

Applications

The assembly technology presented here, using soldering methods, can make the process of fiber assembly more economical and efficient. Moreover, in addition to robust, hermetically sealed and outgassing-free fiber assembly, this technology makes it possible to construct long-term stable and vacuum-tight fiber guides for use in industry and research.

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3 Metal-fiber soldered joint.