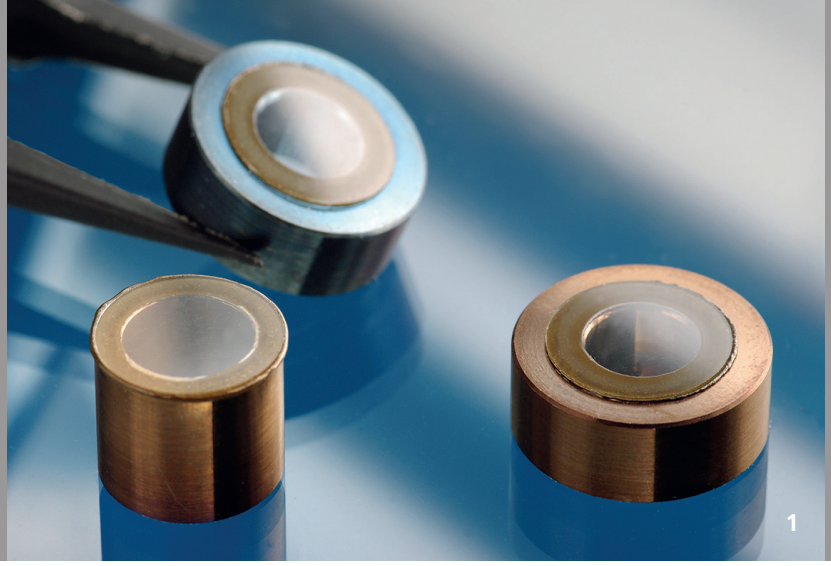



# LASER-BASED GLASS FRIT BONDING FOR THE PRODUCTION OF GLASS-METAL BONDS

## Task

When bonded together, glass and metal constitute an indispensable combination of materials for different applications. The requirements placed on glass-metal connections range from a simple adhesive bond to a load-bearing, temperature-resistant, vacuum-tight bond between the dissimilar materials. Although adhesive joints can compensate for the stresses resulting from the different coefficients of thermal expansion (CTE), they are not suitable for applications with high service temperatures or tightness requirements. Glass frit-based glass-to-metal joints meet these requirements, provided that the CTEs of glass, metal and glass frit are carefully matched.

## Method

So that a strong, hermetically sealed, glass-to-metal bond can be generated with a brittle-hard intermediate glass frit layer, the CTEs of the joining partners must be compatible over a wide temperature range. This boundary condition is fulfilled, among others, by the material combination of borosilicate glass ($\alpha$ = 3.3 ppm/K) and Kovar ($\alpha$ = 5.1 ppm/K). These are connected with glass frit.

The energy required to melt the glass frit is based on absorption of the laser radiation applied. In the quasi-simultaneous soldering process, the laser beam is scanned several times over the joint at a speed of 1000 mm/s and a power of 60 W. After about ten seconds, the frit melts and wets both joining partners. This method was used to produce a load-bearing connection between the glass cover (thickness: 400 µm) and the metal sleeve (diameter: approx. 10 mm).

## Results

By means of laser-based glass frit bonding, borosilicate glass covers could be bonded to metal housings made of Kovar, with bonds that are both sealed and able to carry loads. The glass solder can also be used to bond silicon and Kovar with a positive-locking connection.

## Applications

Applications for this method can be found, for example, in the optical assembly or the encapsulation of optical sensors.

## Contact

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*1 Glass-metal connections consisting of a borosilicate glass cover and a Kovar sleeve.*



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