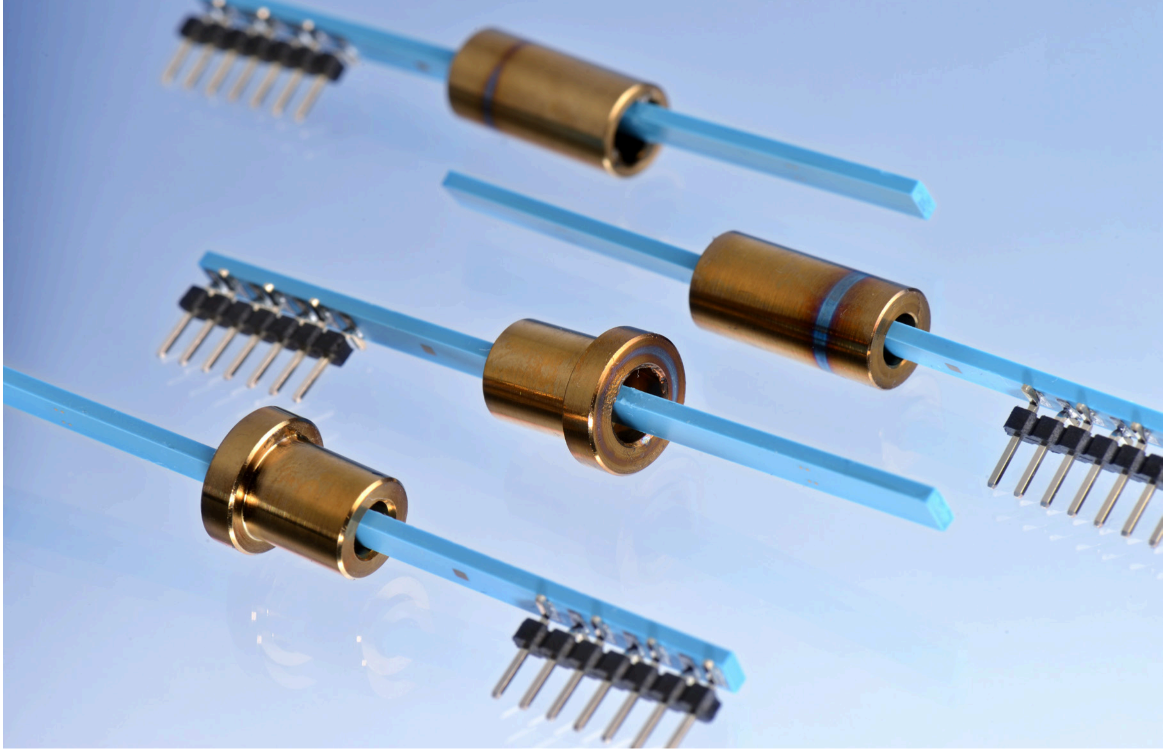

Laser-based manufactured compressed glass feedthroughs for LTCC.

Compressed glass feedthroughs for temperature-sensitive components

When hermetic encapsulations are designed, compressed glass feedthroughs are often used as a contacting interface between the sensor unit and the evaluation electronics since they can withstand high temperatures, high pressure and aggressive media. These feedthroughs consist of a metal outer part (mount), a sintered glass body and usually metallic inner conductors. Traditionally, they are manufactured in a furnace process lasting several hours, in which all components are heated to the melting temperature (> 400 °C) of the glass. The furnace process is unproblematic for metallic conductors. However, a furnace process is unsuitable if the conductors are replaced by a multilayer ceramic made of low temperature co-fired ceramics (LTCC) with integrated structures and temperature-sensitive elements. A manufacturing process is then required in which the thermal load is minimized and the critical thermal destruction threshold of the individual components is not exceeded.

Laser instead of furnace

Unlike a furnace, the laser applies energy locally so that the temperature load for temperature-sensitive components can be reduced and damage avoided. The radiation emitted by the laser is focused on the metal mount. The radiation energy absorbed by the mount is converted into thermal energy, which leads to a rapid rise in temperature. Part of the heat is conducted into the glass body, which wets both the mount and the LTCC ceramic as soon as the melting temperature of the glass is reached. In this way, pressure-resistant and helium-tight connections are created. (Pressure resistance > 800 bar, leakage rate in the range of 10^{-9} to 10^{-10} mbar*l/s).

Local energy input reduces thermal load

Investigations have shown that the LTCC ceramic is subjected to the greatest thermal stress by the laser process in the wetting area. Temperatures equal to the melting temperature of the glass body are reached here. As the distance increases in the longitudinal direction, the temperature of the ceramic drops to below 100 °C. The functionality of temperature-sensitive components is maintained there. The work was funded by the Federal Ministry for Economic Affairs and Energy on the basis of a resolution passed by the German Bundestag.

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