Assembly of the $LiNbO_3$ waveguide for quantum applications

Quantum technology is playing an increasingly important role in many fields, including telecommunications. For such applications, quantum telecommunication modules are needed, which can be built with periodically poled $LiNbO_3$ waveguides. In order to achieve the necessary optical frequency conversion, the waveguide must be tempered differently in two zones and the transition region between the zones must be minimal. The central challenge of the joining technique is the different thermal expansion of the waveguide zones.

Use of active soldering technology

In addition to how the module is designed, selecting the joining technique plays a central role in the present task. To ensure sufficient thermal conductivity and elasticity of the joint, Fraunhofer ILT used an indium-based brazing material. Since the waveguide cannot be readily metallized, an active soldering technology was used for assembly. This way, sufficient wetting was achieved on both the $LiNbO_3$ waveguide and the additively manufactured holder.

Result and fields of application

The temperature control tests showed that the two zones can be thermally separated with a 40 mm long waveguide. A temperature of 20 °C over a length of 10 mm was achieved in the 15 mm zone and a temperature of 30 °C over a length of 20 mm in the 25 mm zone. The waveguide remained intact after tempering. The joining concept described can be used in other areas such as medical or measurement technology.

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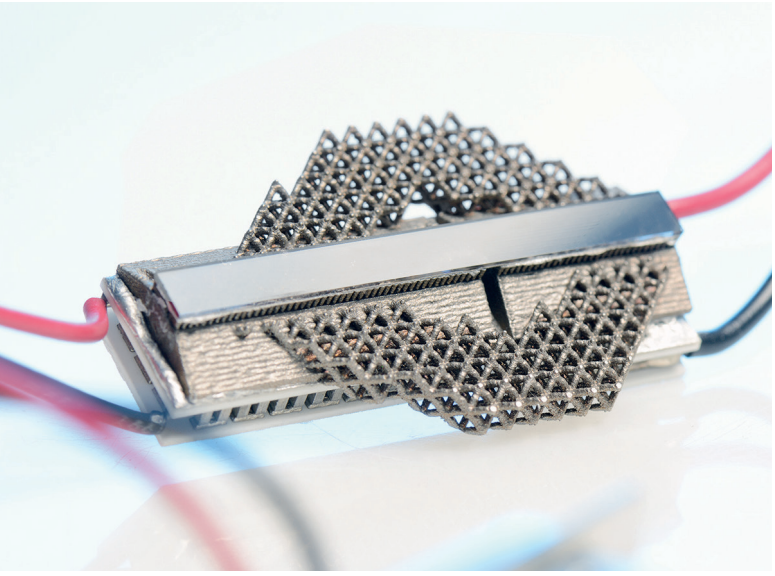

Waveguide soldered onto the holder..

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