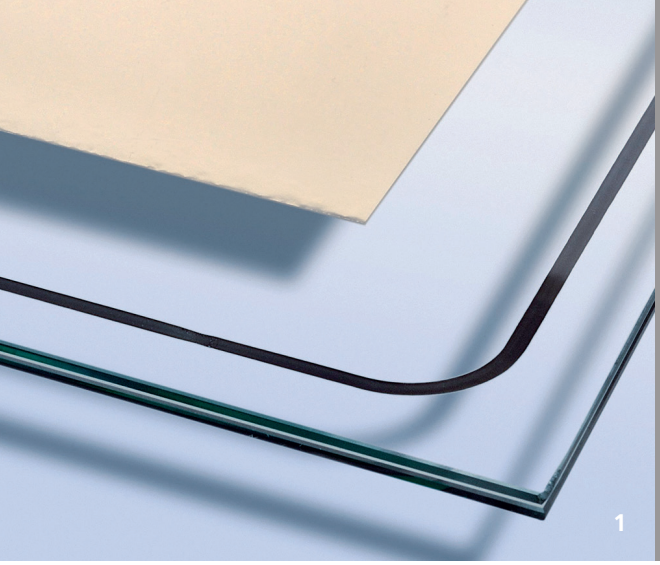

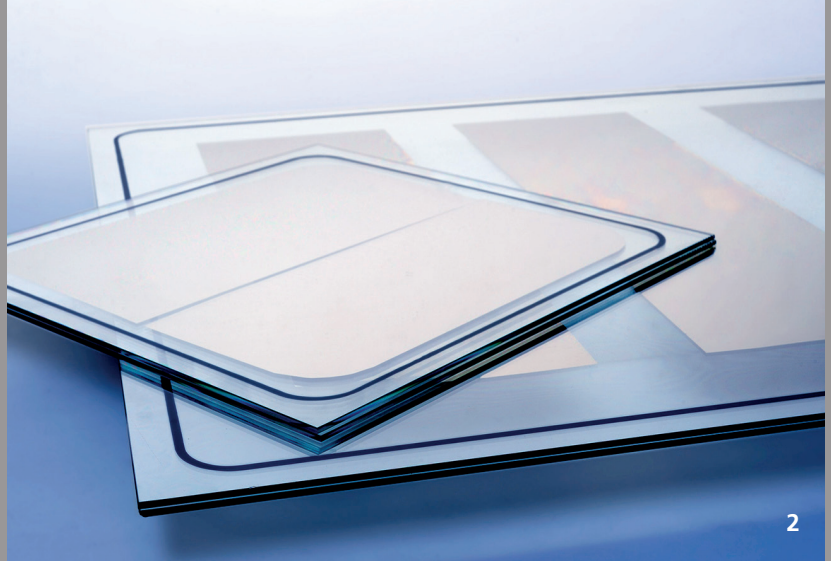

LASER-BASED GLASS SOLDERING PROCESS FOR THE EDGE BONDING OF VACUUM INSULATION GLASS PANES

Task

Over the last few years, research on the thermal insulation of buildings has identified windows as a critical weak point for efficient insulation. One approach to counteract this is a double-pane construction with a vacuum gap. In addition to providing excellent thermal insulation, this approach is characterized by a slim design and a significantly reduced weight compared to conventional approaches. For the so-called vacuum-insulation glazing, a vacuum-tight edge joint is absolutely necessary to maintain this vacuum and the resulting good insulation values. Fraunhofer ILT has been developing and examining a laser-based glass soldering process to generate such a joint.

Method

The contour soldering process is used for large components such as vacuum-insulated glass panes. In this case, the laser beam is moved continuously over the joining zone. The connection is formed continuously in the region of the glass solder contour, over which the laser beam passes. The size of the glass panes is not restricted by this type of process. Float glass, which responds highly critically to thermal stresses, places very high demands upon process management. So that critical temperature gradients can be prevented, an adapted thermal management of the laser-based soldering process is imperative. In addition to a temperature control of the panes that accompanies the process, the irradiation strategy is decisive for the homogeneous energy input into the radiation-absorbing glass solder.

Results

A laser-based glass soldering process vacuum has sealed safety glass panes measuring 720 x 640 mm² (material thickness 3 mm) successfully. Due to the thermo-mechanical properties dependent on the glass material, a connection could be formed at a speed of 15 mm/min without cracks. Ten-fold higher feed rates could be achieved for applications that allow the use of significantly thinner glass (< 1 mm).

Applications

Further possible applications of the method are the edge sealing of OLEDs, displays or dye solar cells.

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1 Homogeneous, crack-free solder joint.

2 Vacuum-sealed soldered glass panes (dimensions 720 x 640 mm² and 340 x 340 mm²).