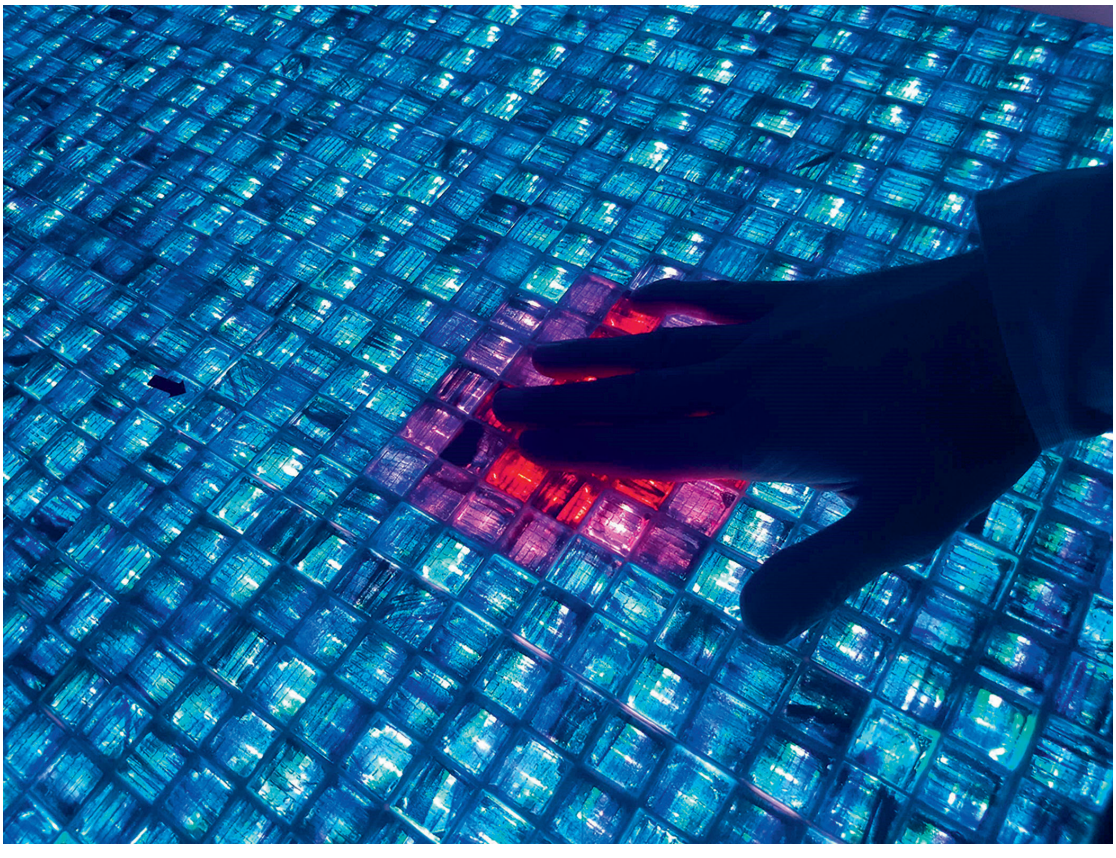
Colors at Your Fingertips

Luminous Mosaics with Laser Welded Electronic Modules

Touch-sensitive lighting modules that are the size of a palm and about as thin as a matchbox can create varying light mosaics thanks to digital control. The electronics behind this construction are situated in a flat plastic housing and are securely welded using laser technology for their protection.



When the mosaic surface is swiped, the modules light up in the desired colors in the touched areas

© volatiles lighting

The company volatiles lighting has reinterpreted the glass mosaic (**see Box**): a mosaic of lighting modules with changing colors can create any combination of dazzling decorative effects on surfaces. It consists of light modules called "volatiles," which can display millions of colors, a different one for each mosaic tile if so desired – and in a flash, so to speak. This is because each mosaic tile is sensitive to touch. You can change the color of the light with a swipe across the wall or draw any pattern on the wall (**Title figure**).

Safe and Tight Joining Technology

The idea sounds fascinating, but the implementation was a challenge from the very beginning. For example, in order to accommodate the electronics needed for control in a space-saving and secure plastic housing, the design office had to find a technology that could handle small dimensions as well as guarantee the safety and tightness of the housing. In 2015 a decision was made in favor of LaserMicronics. The service provider for micromachining of materials recommended welding the plastic housing using laser technology.

Other joining technologies often have disadvantages regarding strength, tightness, and purity. For example, ultrasonic welding can cause fine dust that can impair the functionality of the electronics. Bonding processes are visually less appealing and usually have wider joints, and the additional chemicals introduced can affect the long-term appli-

Fig. 1. The light module electronics must be situated in a tightly welded protective plastic housing for wet applications © volatiles lighting

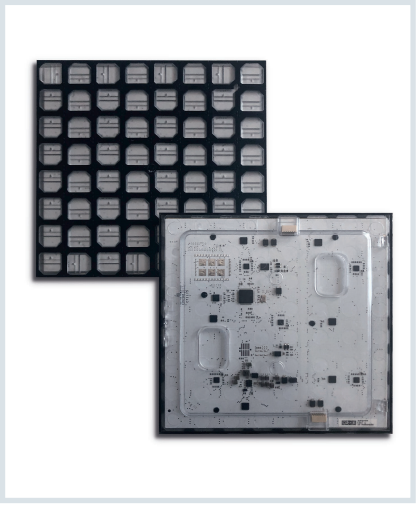


Fig. 2. Ready for assembly: there is space for 64 glass mosaic tiles on the top side of the electronics housing © LaserMicronics

cation. In contrast, laser transmission welding is gentle – without chemical, thermal, or mechanical influences on the surrounding material.

After the first concrete drawing, a decision was made in 2016 after material tests for polycarbonate (PC), which appeared to be the optimum material for this application due to its light transmission, dimensional stability, and optics. As a thermoplastic material, PC is very well suited for laser transmission welding.

High Optical Demands

From the very beginning, the greatest challenges for joining the components were to ensure the strength and tightness of the weld seams and to satisfy the high optical requirements. Although the plastic bases of the volatiles are no longer visible after installation, they should not only be of high quality and reliable in function but also satisfy high optical demands.

To meet the requirements, LaserMicronics decided to use LPKF's PowerWeld standalone laser system, which unites the laser, the control unit, and the cooling system in a compact housing. Workpieces of different sizes can be produced flexibly with the machine, which means that changes can easily be made to dimensions or shapes during development. An integrated online process monitoring system checks the weld seam quality. The process was qualified by welding under conditions similar to those of series production with the selected material.

Right from the start, LaserMicronics relied on the welding method of contour welding, which introduces the heat generated during traversing of the given contour rapidly and only in localized regions. This process is generally used for small to large components such as car body parts, automotive lights, or solar panels as well as for microfluidic components and 3D applications. For the lighting modules, the pure welding time is 9 s; including manual feeding, a welded module is produced in less than 30 s. The weld seam is just 1 mm thick.

In May 2016, LaserMicronics began manufacturing the housings for the volatiles electronics, initially as a part of the development of the modules (**Fig. 1**). Mass production of the digital glass mosaic modules of the Berlin-based lighting technology company has been running with steadily increasing volumes since September 2017. "The advice we received regarding the production process and the material quickly led to the desired results," says Florian Nübling, Managing Director of volatiles lighting, in praise of the collaboration. The rapid completion of the entire project by LaserMicronics also had a very positive impact on the market entry.

In the years since then, the light technology company has won various prizes for its modern lighting design and is selling the glass mosaics in increasing numbers worldwide. ■

Company Profile

Volatiles lighting GmbH is a lighting technology company founded in Berlin, Germany, as a result of a joint research project between the Karlsruhe Institute of Technology, Germany, and the Free University of Berlin. It develops and produces intelligent area lighting systems equipped with the latest LED technology, sensors, and radio technology. The entire technology is integrated into ultra-flat modules, making external control devices unnecessary. Various lighting scenarios can be downloaded via a smartphone app and streamed onto the mosaic wall.

↘ www.volatiles.lighting

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