Success Story
1 / 2014

Contour welding with Leister

Automotive

Light for the automobile industry

An innovation for door handles in the vehicle industry has been created by *Magna Mirrors*: An indicator light has been fitted into a door handle as a design element. LEDs are used in many lighting areas nowadays. The technology allows flat designs and therefore also the use of new design elements. The tight sealing of joins is however a prerequisite for the use of such components. Laser welding of plastics is a technology that meets all requirements in such joins.

High quality requirements

As the indicator light is fitted to the exterior of the vehicle (fig. 1), it must be capable of resisting all adverse environmental effects. An all-round welded seal is necessary to protect the electronics built into the device. Scratches on the transparent cover are to be avoided for aesthetic reasons. The main body of the indicator light is fitted with the finest electronics and LEDs. An aluminum reflecting layer is also applied. The light consists of a plastic body made from PC/ABS and is joined to a transparent PMMA cover. Further demands are placed on the welded seam

Figure 1: Two-part indicator light from *Magna*

– in addition to the sealing properties: Most plastic welding methods are based on melting off the seam geometry during the joining process. However, the tolerances to be maintained in the indicator light only allow this to a very slight extent. Laser transmission welding using the contour method (fig. 2) is therefore the optimal joining technique for meeting these conditions.

Not an ideal starting point

The joining of the indicator light was originally designed for ultrasonic welding. The melting and associated material flash from the weld in this method does not however give the light an acceptable appearance. The laser welding method was therefore tested as an alternative. As laser transmission welding is still a relatively recent technology, the design requirements for the components are still not widely known. Ejector marks and injection points

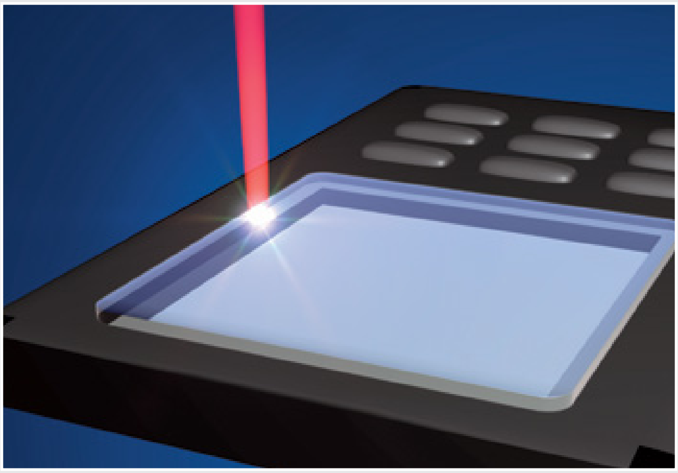


Figure 2: Contour welding process

in the weld seam are particular welding problems. The first components made had such ejector marks in the weld seam. These components were also not in an optimally absorbing gray tone. The high laser power required and the relatively slow welding speed led to a high melting rate with little material flash. This certainly bridges the gap of the ejector marks but did not satisfy the basic requirements. Optimization of the ejector reduced the marks to a minimum. Pre-trials with attachment of an additional absorber show a considerable improvement in the weld appearance. A material modification, with a higher proportion of carbon black, led to very good absorption properties in black components.

Optimal solution enabled

An additional challenge is the height of the web in the transparent cover. In the welding plane, this height varies between 4.5 and 6 mm. The width of the web, on the other hand, is a mere 1.1 mm. The ratio of height to width is less than optimal for laser welding. The laser beam must be perfetly coupled into the surface of the transparent partner to give a good weld appearance. Here, the web is illuminated over the whole width by total reflection and the weld seam is therefore also limited in width. If the coupling is too low or too high, the radiation sidewards next to the web can result in burning of the main body. The web of the transparent cover is also positioned by a cavity in the main body. The width of this cavity should also limit the manufacturing tolerances in the injection molding process. Distortion of the individual components in this process is probable because of the three-dimensional form of the light. As the laser beam always follows the same contour, however, distortion of the cover when engaging could give rise to problems. Leister has therefore built additional positioning points into the clamping mechanism. These are responsible

Figure 3: NOVOLAS WS-AT from Leister

for alignment of the two components to each other and for the positioning of the component relative to the laser beam.

High flexibility

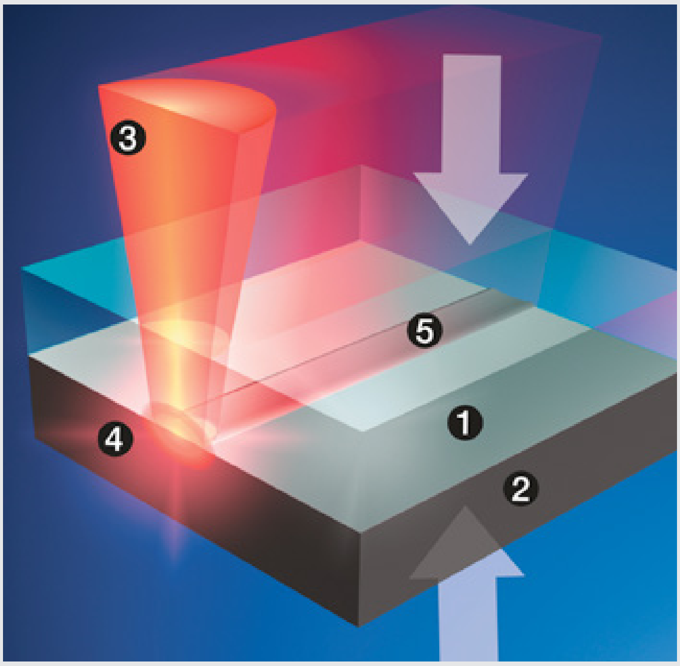
It has again been shown that the selection of the joining process for components must already be considered and tested in the development phase. As soon as the method is qualified, many „downstream“ problems can be avoided. Leister was able to assist Magna to a positive conclusion in the case of the indicator light. It was even possible here to exploit the flexibility of the contour welding process to weld three-dimensional parts securely and without contamination. Another alternative would have been simultaneous welding by means of laser beam. In this, the entire welding surface of the component is plasticized simultaneously. In general, such a method is beneficial in time but involves much higher costs. The production quantity planned for the indicator light is around 150,000 pieces/annum. A small quantity that, for a component size of 197 mm x 23 mm x 17 mm (L x W x H), can also be welded using the contour method.

Leister as solution provider

Leister‘s many years of experience with different plastic materials, product design, workpiece fixtures and laser welding concepts have again helped to define the optimal process. The laser welding method was brought to production maturity in a mere six months. Three-dimensional parts are usually welded using an industrial robot system. To keep down costs, however, a NOVOLAS WS-AT (fig. 3) with three servo axes was used for this part. The easy operation of the system and its high efficiency, but with high flexibility, was an additional incentive for the customer.

Provision of comprehensive services

Thanks to the proximity of the Leister subsidiary in Shanghai, it was possible to provide the customer with optimal support during the entire test phase. Tests of materials, welding and functions are possible in the in-house applications laboratory. Workpiece fixtures are designed and built locally. That keeps communication channels small and saves valuable time. The experts from Leister are still there to support the customer, even when the commissioning of the system has been successfully completed.



Basic principle of laser welding process for plastics
1 Transparent joint partner
2 Absorbing joint partner
3 Laser beam
4 Melting zone
5 Welded seam

Magna Donnelly (Shanghai) Automotive Technology Co. Ltd., Shanghai

Magna is the most diversified automotive supplier worldwide. The enterprise develops and manufactures not only systems, modules and components, but also constructs and assembles complete vehicles for original equipment manufacturers all over the world. Magna Mirrors is a hundred per cent subsidiary of Magna International and supplies a very large variety of exterior and interior mirror systems as well as actuating motors, automatically dipping glass and door handle systems.

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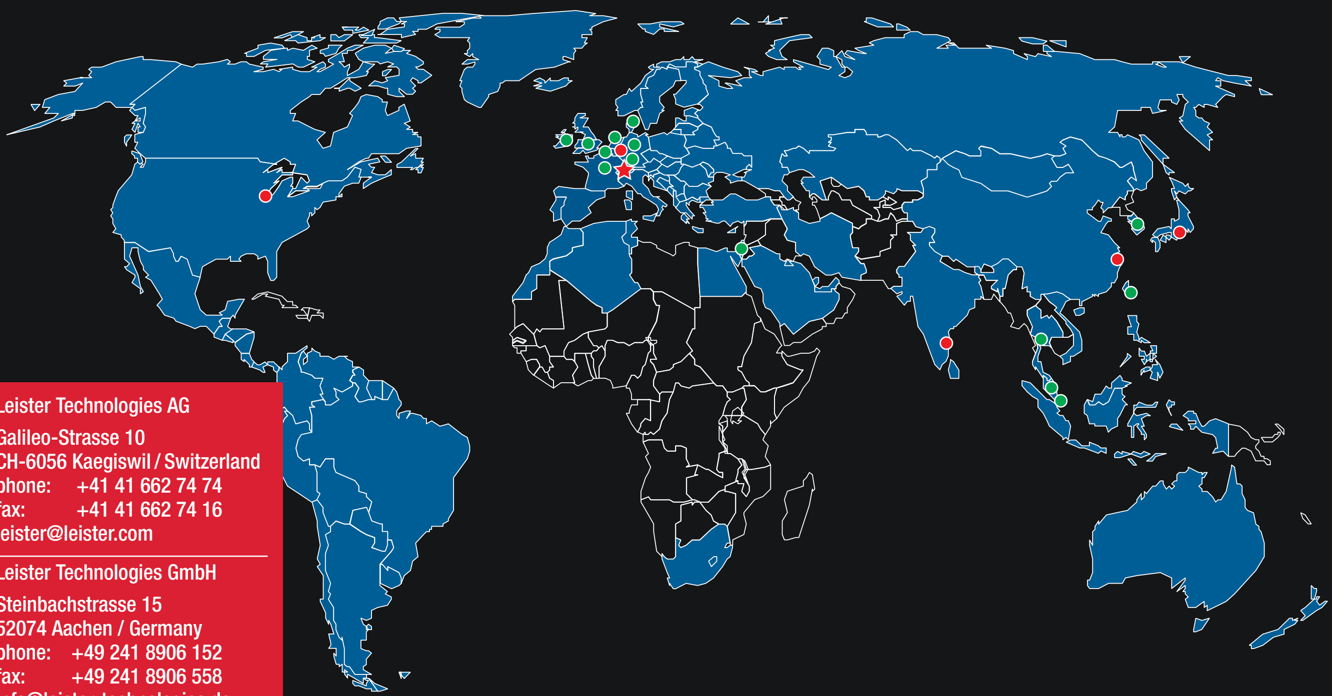

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