TELSONIC
ULTRASONICS

Sustainable, flexible and fast

Ultrasonic welding supports innovations in the automotive industry

PLASTIC WELDING | METAL WELDING | CUTTING | CLEANING | SIEVING

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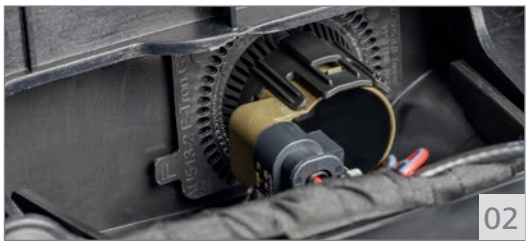
Lightweight construction is set to become an increasingly popular choice as the automotive industry seeks to cut down on weight and save energy while adding more and more functions to vehicles. There are also important considerations such as autonomous driving and alternative drive concepts to factor in. In addition to weight reduction and energy savings, however, aesthetic features are also of central importance for the overall vehicle, and recycling the installed components as easily as possible is also a focus today. Traditional welding and bonding processes often reach their limits, both in terms of sustainability and aesthetics. It is against this background that ultrasonic technology is often seen as a joining method that offers both technical and financial advantages, especially when high-quality surfaces are required – and it is undoubtedly set to continue gaining acceptance into the future.



01 Audi RS e-tron GT (Source: Audi AG)

02 Sensor bracket welded to bumper using ultrasonic welding

03 Audi RS e-tron GT bumper

The term “ultrasonics” is used to describe sound frequencies above the human hearing threshold; that is, above around 20 kHz. Frequencies in the range of 20, 30, or 35 kHz are used for cutting and welding. They are produced by a piezo-converter that causes a sonotrode to vibrate at high frequency, which is particularly effective in resonance and at the same time requires little power. Using this method, strong bonded joints can be produced without exposing either the product or its environment to high thermal stress. For particularly sensitive surfaces, however, conventional linear ultrasonic joining technology is not always the best choice – mainly because of the thermal material stress that is always present.

Gentle, thin-wall welding without markings

Telsonic has therefore developed the torsional SONIQTWIST®, an ultrasonic welding process that significantly expands the range of applications for efficient joining technology, particularly with regard to lightweight construction. For example, the process is ideally suited for vehicle bumpers made of polypropylene (PP). This patented and extremely gentle welding process enables wall thickness to be significantly reduced (<2.5 mm) without producing visible marks on Class A surfaces of already lacquered vehicle parts (Fig. 3).

04 SONIQTWIST® Sonotrode, which can be integrated very well into robotic solutions or even existing machines

05 Cupra Born side sills

The advantage of the torsional method is that the vibrations are introduced into the area surrounding the weld seam only to a small extent. This preserves sensitive components and surfaces, and also achieves higher energy densities in the welding range. The result is a firm, mechanically stable connection that can also withstand strong vibrations. This is how the process works: Generally, the welding system is arranged vertically. The vibrations are applied tangentially to the component, however, with the sonotrode moving the upper workpiece horizontally in relation to the lower workpiece. A melt is created between the workpieces through the high vibration frequency of 30 kHz with appropriate amplitude and welding pressure. At the same time, the torsional movement of the sonotrode ensures that the area around the welding zone is scarcely impacted by the ultrasonics. The process is therefore especially suitable for sensitive applications such as thin-walled bumpers that have already been painted, where vibrations and temperature input outside of the welding zone could cause damage.

Bumpers are more than a trim

Nowadays, bumpers are far more than a trim. Increasingly, they are incorporating features such as sensors and have to cope with the growing demands being made on design. Lightweight materials already offer a wide range of options in that respect, and will continue to do so in the future, which is supported by torsional ultrasonic welding. Brackets on thin-wall bumpers can thus be fitted with particular ease. Compared to conventional ultrasonic welding, SONIQTWIST® requires only 1/5 of the welding time and achieves greater strength. Magna Exterios, for example, a globally active Tier 1 supplier of trim components and systems, started using the process as early as 2017 in its production process, such as for the bumpers of current Skoda vehicles in the Fabia, Oktavia, and Kamiq series. In 2018, Magna received the Automotive SPE and ACE Innovation Award, scooping first place in the Enabler Technology category. It recognizes outstanding achievements in industrial products and processes that play a pioneering role in the industry. The minimalist design of the sensor brackets, for example, results in enormous material savings. But ultrasonic technology also scores points for sustainability in other respects. For example, no additives are required as with gluing, which facilitates the subsequent recycling of the components. In addition, nothing needs to harden. The parts joined with ultrasonic technology can be processed immediately.

06 Ventilation module

07 Andreas Helfenberger, Team Leader for Sales & Project Management Plastics, Business Unit Automotive, Telsonic GmbH

Equipped for the future

Torsional ultrasonic welding technology is well-positioned for the future. A wide variety of plastic materials – including, for instance, materials with a high natural fiber content or recycled plastics – can already be processed today. In this case, Telsonic works closely with users from the automotive and consumer sectors and is regarded as a reliable development partner for complex application solutions and their industrialization. This applies to OEMs and Tier 1 suppliers as well as to machine builders.

Furthermore, users' requests from the past several years were also implemented in an upgrade. This includes, for example, a space-saving, streamlined design so that the SONIQTWIST® sonotrodes can be integrated very well into robotic solutions or even existing machines (Fig. 4). The range of applications for the patented torsional ultrasonic technology is therefore widespread. Typical applications in automotive engineering also include interior trims, door sills (Fig. 5), ventilation modules (Fig. 6), spoilers, dashboards, and much more. Linear ultrasonic welding is also suitable for some of these applications.

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