Press Release

Technical report on torsional ultrasonic welding procedure

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The ultrasonic welding procedure developed by Telsonic gives the automotive industry process reliability as well as cost and weight advantages.

Joining plastic parts to painted parts with high process reliability and pull-off strength

Torsional ultrasonic plastic welding procedure delivers firm results Joining plastic parts to finish-painted exterior parts reliably and permanently with pull-off strength and without markings is considered a big challenge in the automobile and automotive supplier industry. A new torsional ultrasonic welding procedure, whose effectiveness has been supported by university research results, provides convincing results. In addition, users can save costs and weight. Parts can be designed markedly thinner.

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The secure and firm joining of two plastic parts is a long-known process, which can be reliably carried out with the usual procedures, such as longitudinal ultrasonic welding or adhesive procedure But if the other part to be joined is painted or the geometries are different, either the process becomes very complex or the results leave much to be desired. Here the torsional ultrasonic welding procedure Soniqtwist, which was developed by Telsonic, can provide good results. Parts to be joined can be joined quickly and securely with high pull-off force without leaving marks on the painted outside. The process can be reliably controlled, monitored and performed with repetition accuracy. Automation with the usual handling equipment can be installed without major investments.

For the automobile industry, joining of plastic parts made of Thermoplast has always been an important topic. And so plastic parts for additional functions, such as distance sensors, cable clips or fixing pins in painted bumpers, are attached to side skirts or other exterior parts. For example, when attaching plastic holders for distance sensors to the inside of painted bumpers, conventional joining procedures provide satisfactory results only with great additional expense. Especially the lack of strength is complained about repeatedly. This is reported by manufacturers of sensors that became loose after a short time and fell into the bumper. Besides strength, it is especially important that no marks are visible on the already finished-painted parts. Here, the criteria are especially strict and are uncompromisingly checked with a special light test.

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Inserts high energy in a very short time

Strictly speaking, Soniqtwist is a high-frequency friction welding procedure in which the sonotrodes carry out torsional movements around their longitudinal axis alternatingly in one direction, then in the other. In a very short time - between 0.1 and 0.4 seconds - much energy is applied to the boundary surface of both parts, with a very high frequency of 20 kHz and an amplitude of up to 80 µm. This boundary surface friction creates a sufficient melt layer to join both parts to each other and achieve high strength. Pull-off strengths of 500 newtons or more can be achieved, depending on the component and requirements.

The painted bumper is not damaged, as can happen with longitudinal ultrasonic welding procedures. For this procedure uses neither sonotrodes that weld off energy directors nor a so-called "hedgehog" sonotrode with small needles that penetrate into the bumper for up to 30% of its material thickness. But this "hedgehog" sonotrode does not create a bond over the entire surface. Strength is achieved only through the welding beads that form around the individual penetrating tips. This procedure is hard to control. Soniqtwist, in contrast, works without energy directors and so without penetration by the sonotrodes into the bumper. As a result, due to process reasons, the danger of marks is not expected.

Material can be designed considerably thinner

Because the sonotrode tips do not penetrate, the material thickness of the painted part can be considerably less with use of the torsional ultrasonic welding procedure. For example, the wall thickness of a production vehicle's bumper can be up to 20% less. The savings in materials and weight can be considerable. Looked at over the life of a volume model, this results in very significant cost savings. Due to less weight, the CO_2 values of the vehicle model can be improved.

No logistics effort and no risk of confusion thanks to identical parts

In addition, the torsional ultrasonic welding procedure does not require additional auxiliary surfaces. Since Soniqtwist achieves high strength due to the procedure itself, users do not need extruded functional surfaces ("ears" or "wings") on the holding devices. With the conventional ultrasonic welding procedure, these also had to be adapted to the geometry of the bumper. This meant different functional surfaces for parts attached to the curved area of the bumper with large radii than on places in the middle. Additionally, holding devices on the left and right side had to be different. An immense logistical expense, which entails the risk of errors and confusion. With Soniqtwist, the same parts can usually be used at all places.

The expense is also considerably lower compared to the adhesive procedure, in which the surfaces must be absolutely free of

grease and prepared with primer before attaching the plastic parts with adhesive pads. In addition, to prevent paint mist deposits on the adhesive points, these must be masked before painting. Temperature fluctuations can influence the adhesive result. The entire process cannot be monitored exactly.

Automation and quality assurance are possible

The advantages described here of the torsional ultrasonic welding procedure compared to other ultrasonic joining procedures were previously discovered in in-depth experiments under strict scientific conditions at the Chemnitz University of Technology. Joining of large-surface components is planned in a next step. Also examined were the results provided by the torsional ultrasonic welding procedure Soniqtwist when joining glass-fibre-reinforced and carbon-fibre-reinforced parts.

In addition, for practical use in the automobile industry, experiments by the OEMs as well as process security and process monitoring are decisive. Here, too, Soniqtwist meets the high requirements for process and quality control. The familiar process control from ultrasonic welding procedures can be used completely. All parameters, such as frequency, duration of welding or energy application, can be set and output and monitored at any time through windows.

Automated production cell with robots

Since the procedure permits identical parts and the sonotrodes are small and light, automation with handling support is easily implemented. Machine set-up can be designed very lean. No special machines are necessary. The joining tool can ideally be mounted on a commercially available robot and can be steered quickly and flexibly to the joining spot, even in hard-ro-reach areas. For example, together with a robot manufacturer, a fully automated production cell can be installed which welds receptors for distance sensors in bumpers with high process reliability and repetition accuracy.

Image no. 27-01 TC_Soniqtwist_4Teile.jpg
The torsional ultrasonic welding procedure of Telsonic AG delivers best results in joining plastic parts, such as distance sensors, cable clips or fixing pins, to painted exterior parts in automobile manufacturing.

Image no. 27-02 TC_Soniqtwist_3Teile.jpg
Quality control meets the high requirements in automobile manufacturing. The familiar process control from ultrasonic welding procedures can be used completely.

Image no. 27-03 TC_Soniqtwist_gruen.jpg
Since the sonotrode does not penetrate the painted part, the part can be designed with significantly less material thickness. For example, the wall thickness of a production vehicle's bumper can be up to 20% less.

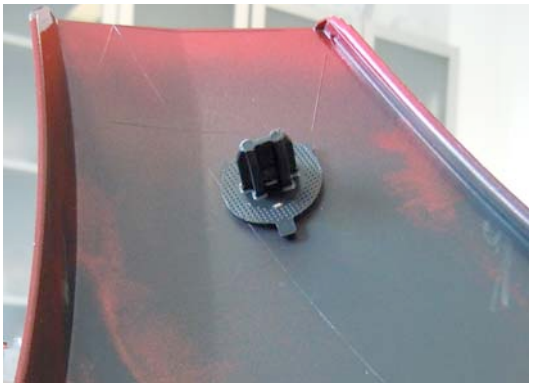

Image no. 27-04 TC_SQ-FixierPin.jpg
The parts to be welded, such as the fixing pin shown here, can be designed without special additional measures to design the joining surface.

Image no. 27-05 TC_SQ-Sonotroden.jpg
The sonotrodes apply much energy with a frequency of 20 kHz and an amplitude of up to 80 µm in a very short time to the boundary surface of the parts to be joined.