Joining Technology. The issues presented by the suppliers from the industry were just as diverse and widespread as the area of joining technology itself. Apart from technical innovations for process and plant engineering, the focus was on the subjects of lightweight construction, quality control and conservation of resources.

The Diversity of Joining

While striving for intelligent lightweight solutions, companies from all industrial sectors are involved in research and development on this issue. Their focus is not only on large components.

Plastics Screws Support Lightweight Construction

Joining elements such as screws and bolts are considered, as well, concerning their suitability for lightweight construction, according to **Ejot GmbH & Co. KG** in Bad Berleburg, Germany. Its Delta PT screws designed for direct assembly of thermoplastic materials are one example of use in lightweight construction. For some types of application, these steel screws can reduce weights thanks to their reduced dimensions (length and diameter). What is more, the company considers a smaller number of joints sufficient in many applications. Additional weight can be reduced by choosing the right material. Ejot Delta PT screws, for instance, are also available in aluminum and in a brand new plastic version.

The new Delta PTP is made of a PPA-GF50 material with a 50 % glass fiber content, offering the same safety of joint at a weight considerably reduced, as compared to metal screws **(Fig. 1)**. A plastic Delta PTP screw weighs up to 85 % less than its steel counterpart of comparable dimensions.

Fig. 1. Employing Delta PTP plastics screws saves weight (figure: Ejot)

News of Radial Welding

With its Radialoptik 68 component, **Leister Technologies AG** in Kaegiswil, Switzerland, introduced an optical component designed for the Basic AT and Novolas WS-AT laser welding systems **(Fig. 2)**. This special optical unit is suitable for (radial) welding of rotation symmetrical components at diameters up to 68 mm.

During radial welding, a mirror usually deflects the laser beam so that it hits the rotation symmetrical surfaces of the components to be welded at radial angles. Compression tension between the parts to be joined provides the contact pressure required. Moreover, it is not necessary to move, i.e. turn, the part.

The radial optics unit generates a circumferential distribution of energy density on a conical mirror. This mirror then reflects the beam at orthogonal angles to the welding surface. As a result, a rotation symmetrical weld line is obtained, simultaneously. Typical applications of this process are the welding of hose couplings and covering plates.

Fig. 2. Radialoptik 68 designed for welding rotation symmetrical components in the radial welding process (figure: Leister)

Welding on a Table System

With their PrecisionWeld laser welding system and their contour welding unit ProtoWeld designed for small series and prototypes, **LPKF Laser & Electronics AG** in Fürth, Germany, presented two novelties at a time, at the trade show on the river Rhine. The PrecisionWeld unit is specially designed to weld fine channels for microfluidics applications. The system is able to generate weld lines of a mere 100 µm. Its accuracy of positioning and reproduction is 10 µm. The unit is able to connect two components, without particles, flashes or additives impeding the delicate channels. The equipment features a scanner system to guide the laser beam, and a positioning table with an effective working area of up to 320 mm × 320 mm. An integrated camera system allows for the detection of specially applied marks or geometric elements on the component. This is how the unit makes it possible to compensate tolerances in the component or in its fixture.

Applying 1,940 nm laser wave length, the unit enables the user to join two transparent components without additives, if employed together with the ClearJoining technique. And finally, a newly de-

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veloped clamping technique compensates manufacturing tolerances from previous production stages.

The new ProtoWeld contour welding equipment is a turnkey and cost-saving system that can easily be operated. Its fixtures can be equipped manually **(Fig. 3)**. A computer program serves to control the welding contour. LPKF claims that the components are joined reliably even with low joint depths.

Moreover, the enterprise presented several examples of their various types of welding equipment from their product portfolio. The PowerWeld line was shown representing the standalone systems, with a closed variant and a version with a rotary table shown for each of the units. As an example of types of equipment that can be integrated into production lines already existing at the customer, LPKF showed an InlineWeld 6200 unit. With welding head and control or laser equipment, respectively, as separate units, the design helps save space in the operating area.

The InlineWeld 2000 special system is a modification designed for radial welding. LPKF TwinWeld3D is a hybrid welding unit designed for large, three-dimensional moldings. It is suited for high-end and cost-efficient welding in the visual field.

A Look into the Live Laboratory

At the booth of **Herrmann Ultraschall GmbH & Co. KG**, Karlsbad, Germany, ultrasonic on-line process monitoring and test methods for the evaluation of weld lines were at the focus of attention. Visitors could look behind the scenes of the application laboratory at their site. The company showed initial tests for welding applications as well as evaluation and verification of the findings. Using a high-speed camera, the effects of weld forces, generation of the melt and natural oscillation of the parts were visible **(Fig. 4)**. It provided information whether weld line quality was good, or if the component itself or the parameters needed to be optimized. Additionally, thin sections were cut with a microtome and submitted to microscopic examination, to detect the weld line's homogeneity. Tensile and bursting tests were also carried out at the laboratory, in order to determine rigidity and leak-tightness.

Fig. 3. Cost-saving technology is the outstanding feature of the new ProtoWeld unit LPKF offers as a turnkey table system (figure: LPKF)

Energy Saving in Butt Welding

The butt welding machines of **Wegener International GmbH**, Eschweiler, Germany, can be upgraded in the future with an optional energy saving function called Eco-Matic. According to company information, this feature can reduce the heating element's consumption of electric power during welding and idle times by more than 50 %. Another innovation on display was a hydro-pneumatic bending beam drive for the bending and edge welding machines of the BM series. It moves the bending beam independent of load, and will soon be applied in the standard versions of the BM series.

In the area of welding devices, Wegener presented two novelties: the hot air welding devices Autotherm3 and Exotherm. Autotherm3 was developed on the basis of the established Autotherm2, with optimized operation and a larger and illuminated display. The Exotherm device is controlled and self-ventilated. This hot air welding unit is outstanding for its low weight, handiness and its motor which is particularly efficient and lightweight. Considering design, an approach was chosen entirely different from the usual design (handle – fan housing – heater cartridge), because the fan housing obstructs the view of the working area. Thanks to the lightweight design of the drive motor, the fan housing could be placed in a new position.

The new Bead-ex separating device for beads is the first unit to enable motor-driven sepa- →

Fig. 4. Inside the weld: Live-ultrasonic laboratory at the trade show booth (figure: Herrmann Ultraschalltechnik)

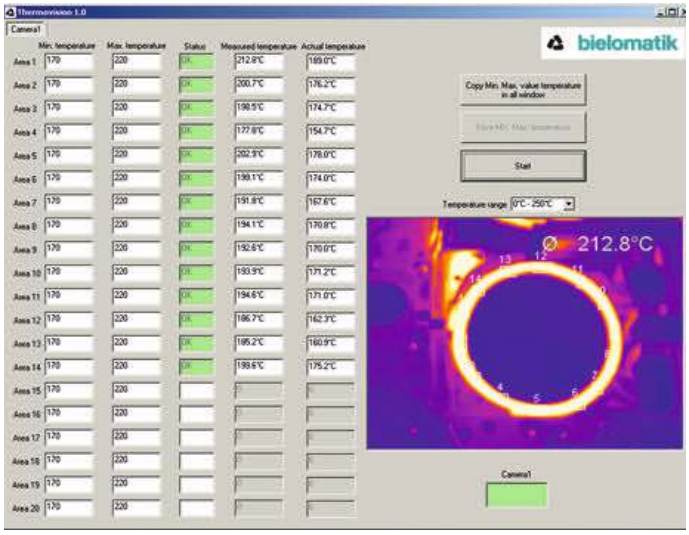

Fig. 5. In-line monitoring of welding processes: bielomatik offers an infrared camera system that precisely determines and checks the temperatures of components to be welded (figure: bielomatik)

ration of beads in the fields of butt welding, 90-degree welding and 90-degree bending, according to Wegener.

Process Monitoring with Infrared Camera

bielomatik Leuze GmbH + Co. KG, Neuffen, Germany, presented a drive concept for their vibration welding machines, which works fast and is designed for high forces. The supplier recently added welding units with an electric actuator to its hydraulically driven equipment. Users now have access to a variant of these welding machines, that saves energy and resources. The lifting table can move and position much faster. In doing so it achieves the pressing forces required when processing the new types of engineering plastics. Programming the stroke movement (700 mm stroke path) is much easier with the electric drive. This is a particular benefit for applications with additional infrared preheating. Featuring a clutch shaft, the electric drive safeguards exact synchronization. High spring stiffness in the vibration head steps up capacity, which means an extraordinary advantage if used for welding spatial geometries. The vibration drive's short times of on-and-off response provide optimum process conditions.

In automotive industry, mainly, a large number of parts are qualified as safety parts and must be 100 % checked. These include parts such as firing channels for airbags, fuel tanks, as well as housings and air ducts for fuel mixing and injection systems. The parameters welding machines usually monitor are often not sufficient, though, to make a detailed statement on the quality of welding. However, manufacturers aim to avoid time-consuming and expensive inspection.

For in-line process monitoring during welding, bielomatik recently introduced an infrared camera system with a temperature measuring feature **(Fig. 5)**. This camera allows for checking the temperature ranges in certain zones of the component after heating and before welding. It is recommended to constantly monitor the weld zones of both parts to be joined. When producing large-surface plastics parts, the "Thermovision 1.0" software developed by bielomatik is able to control and operate up to four cameras. An evaluation program specially developed for practical application in welding, analyzes the measured data provided by the camera, compares it to programmable reference values or tolerances, and evaluates the intensity of heating.

Conclusion

Experts from plastics industry were given the opportunity to learn about numerous innovations around the theme of plastics welding at the K2013 trade show. Not only were there technical innovations on display. The focus was also on issues of sustainability, ergonomics and cleanliness of established welding techniques. ■

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