Electromobility needs new ideas

BENTELER is a family business that operates internationally for customers in the automotive, energy and mechanical engineering sectors. As a metal process specialist, the company develops, produces and sells safety-related products, systems and services worldwide. As a leading global partner to the automotive industry, the BENTELER Automotive Division offers comprehensive vehicle expertise throughout the entire value chain. One part of the portfolio is the development of trend-setting system solutions for electric vehicles. The BENTELER R&D team developed a scalable battery box design based on a folding box with a stainless steel cooling plate integrated into the base. The experts from TRUMPF's battery pack industry management team supported BENTELER in designing a fully automated process chain for series production and using BrightLine Weld technology provided a laser welding process for the pore-free and therefore gas-tight laser welding of stainless steel. In combination with the Multifocus optics specially developed for this task, BrightLine Weld also makes the previously impossible gas-tight welding of aluminum a possibility for BENTELER.

BENTELER Automobiltechnik GmbH

www.benteler.com

BENTELER Automotive is the development partner for the world's leading automotive manufacturers. With around 23,000 employees and more than 70 plants in around 25 countries, the company develops tailored solutions for its customers: The products include components and modules for the chassis, body, engine and exhaust systems as well as solutions for electric vehicles.

INDUSTRY	NUMBER OF EMPLOYEES	SITE
Automotive industry	23,000	Paderborn (Germany)

TRUMPF PRODUCTS

- TruLaser Cell 8030

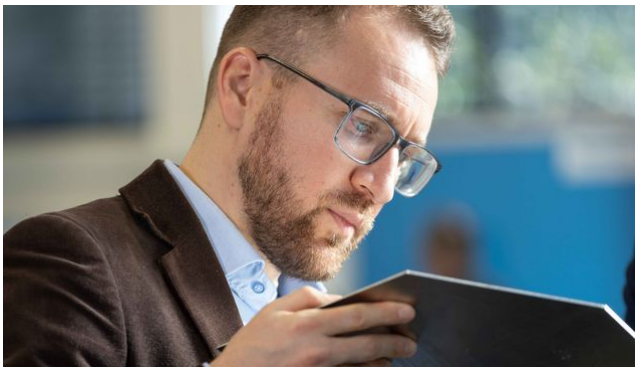
APPLICATIONS

- Laser cutting
- Laser welding
- Laser tube cutting

Challenges

High-voltage battery storage units and the battery boxes that surround them form the heart of electric vehicles. The latter not only protect the sensitive cells from the consequences of crashes, but also from external influences such as humidity and temperature fluctuations, which can have a negative impact on the battery's performance. Until now, these battery boxes have mainly been made of aluminum alloys. They are lightweight and thus aim to maximize the vehicle's range. However, Christian Buse and his colleague Conrad Frischkorn, both development engineers in the Automotive Division at BENTELER, also see great potential in stainless steel as a material. Together they are developing a special design for a flexible and scalable battery box: the folding box concept. A high level of manufacturing process

expertise is required, explains Buse: "We sought support from TRUMPF for the design of the overall manufacturing process. For the experts from the battery pack industry management team, the major challenge was to develop a fast and reproducible laser welding process for gas-tight welding of stainless steel.



"Most people advised us against trying to seal-weld aluminum with a laser. But that actually fueled us."

CHRISTIAN BUSE

R&D TEAM LEADER IN THE AUTOMOTIVE DIVISION AT BENTELER

Solutions

Together with technology and application experts, Mauritz Möller from the battery pack industry management team at TRUMPF is developing a fully automated process chain with punching, cutting and bending technologies for series production of the battery box with integrated cooling plate developed by BENTELER. The gas-tight and helium-tight welding of the parts by laser is possible thanks to existing TRUMPF Technologie BrightLine Weld. With the help of BrightLine Weld it is possible to weld stainless steel with low spatter even at the high speeds used in series production. This eliminates the need for post-processing of the component and protects the machine and the focusing optics. For BENTELER's concept, however, it is crucial that the technology can also be used to produce perfect gas-tight and helium-tight seams, as Möller explains, "The high process speed requires a tailored input of thermal energy - this is the only way to ensure a stable weld pool during welding. Pores can form. BrightLine Weld prevents exactly that." Spurred on by this success, the BENTELER development engineers and the experts at TRUMPF set themselves the goal of also welding aluminum battery boxes with the laser. Mauritz Möller and his team are developing the so-called Multifocus optics especially for BENTELER. In conjunction with BrightLine Weld this has achieved what was previously considered impossible: gas-tight welding of aluminum.

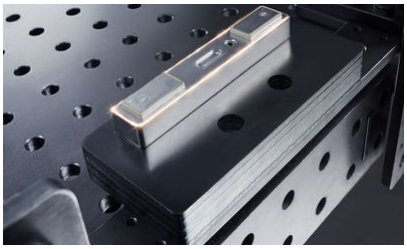
Implementation

BENTELER relies on strategic development partnerships in many areas, explains Christian Buse: "We choose our partners to complement our own strengths. Our customers benefit from this array of different experts in many ways, including faster development times." When working with TRUMPF's battery pack industry management team, he appreciates the communication on a level playing field. "Working with technology experts and being able to run trials with application experts helps us tremendously as a customer of TRUMPF." The foundation of a good working relationship like this is open communication and a lot of trust, he says. "When it fits," Buse says, "everyone involved benefits from the cooperation."

Forecast

BENTELER is always open to new solutions, even if the market is not yet asking for them. "We want to be prepared for everything and be open to anything," explains Conrad Frischkorn. In the electromobility sector, Buse and Frischkorn are certain that their developments are just beginning, particularly when it comes to battery modules and battery box design, as well as surrounding vehicle structures. The duo currently uses the solution developed by TRUMPF for the gas-tight and helium-tight laser welding of aluminum for demonstration purposes. But studies on how safe and reproducible the process is in series production are underway.

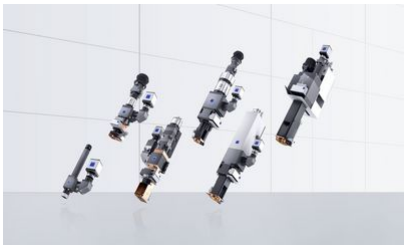
Find out more about our products



BrightLine Weld

You can weld materials such as mild or stainless steel or even copper and aluminum with almost no spatter thanks to TRUMPF's patented BrightLine Weld technology. The patented TRUMPF 2in1 laser light cable (LLK) contains an inner and an outer fiber core. This means that within the laser, laser power can be flexibly distributed between the core, the ring of the 2in1 LLK and the application-specific optimum. This means that, depending on the material, the power distribution can perfectly set for the desired result.

Zum Produkt



Multifocus optics

TRUMPF has developed a new process for the gas-tight welding of cast aluminum components. The heart is a Multifocus optics combined with BrightLine Weld technology. The latter splits the laser beam of a TruDisk laser with multicore fiber between the ring and the core. The processing optics also split it into four individual spots. These are each superimposed with the ring-core split and positioned relative to each other so that they take effect in a weld pool. As a result, they create a continuously open keyhole. This prevents the

Zum Produkt

keyhole from collapsing and therefore the formation of pores due to gas inclusions.

https://www.trumpf.com/en_INT/solutions/success-stories/the-success-story-of-our-customer-benteler/