

remoweld®FLEX – Laser Welding-Optics

Digitized product development and highly networked manufacturing processes drastically shorten development times. Rapid product changes require a high degree of flexibility from manufacturers and suppliers enabling them to offer adaptable and cost-optimized solutions. For the development of new laser beam welding technologies, individualized, material- and product-adapted processes are to be combined with innovative hardware concepts. For welding materials that are difficult to join, Fraunhofer IWS Dresden developed the "remoweld®FLEX" welding optics, which operates with high-frequency beam oscillation and perspective with integrated process monitoring.

laser-based welding processes are being used in numerous industrial products and have significantly contribute to increasing efficiency in production while reducing unit costs, especially in the automotive industry.

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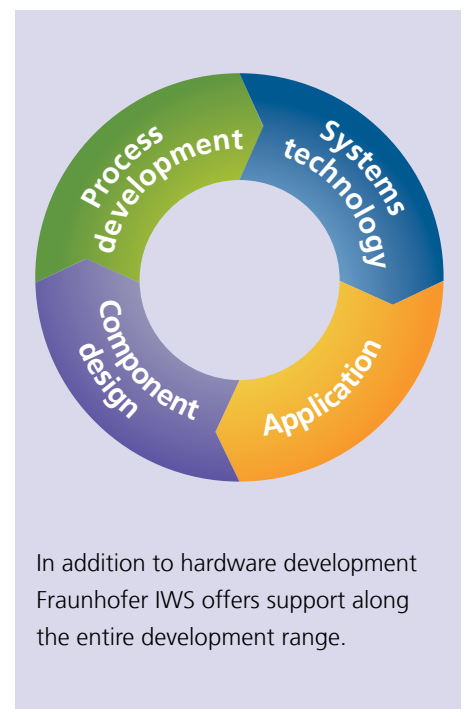
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Driven by the requirements of lightweight construction in mobile applications, increased efficiency of thermal processes and the latest developments in electromobility, ever more demanding weld joints are being produced from various materials. Individualized Fraunhofer IWS process solutions for





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Core: modular welding head concept

The researchers at Fraunhofer IWS have developed a corresponding modular welding head concept, whose HF scanner as the core enables scanning frequencies of up to 4 kHz at a maximum power of 4 kW. A contact-free sensor module is used for the prior weld seam search. A downstream camera-based observation module can be used for quality assurance purposes depending on the application. The process monitoring of all media (cooling, protective gases, electrical signals, process data etc.) is sent via a bus system to a PLC control and processed there. The scientists are currently developing a clear GUI (graphical user interface) that informs the machine operator about the current process status using a "traffic light system". It also offers the option of permanently storing data for quality assurance or forwarding production progress to higher-level organizational units for manufacturing planning in line with the "Industry 4.0" guiding principle. The modular design of the welding head ensures flexibility for an individualized production process, optionally with or without sensor or monitoring module. Fraunhofer IWS offers its customers to develop sensor integration for the respective production process. The processing optics are designed for robotic and CNC machines, but can also be used in stand-alone operation (without additional motion machine), for example for rotationally symmetrical weld joints. Laser processing can also be realized for small series, especially for small and medium size companies.

Versatile use for a wide application range

"remoweld®FLEX" offers a versatile welding optics for a wide range of applications. Laser beam welding with high-frequency beam oscillation creates new potential for combining the complex variables of design, material, process, manufacturing and costs into a high-quality welding result. The best examples are filigree die-cast components which often have to be joined in a media-tight manner to attached parts. Due to the usually high gas content of these materials, such joints cannot be reliably produced with conventional laser beam welding sequences. The combination of highly brilliant beam source and high-frequency beam oscillation, however, enables high-quality, reliable welding of die-cast aluminum materials for the first time. Simultaneously, the welding energy introduced into the component is strongly limited in order to

avoid component distortion. In addition, the system is available for thin sheet applications in medical devices, but also in electromobility for joining thin foils, arresters and busbars.

- 1 *The aluminum die-cast component welded with high frequency beam oscillation uses the "remoweld®FLEX" welding optics to obtain a pressure-tight weld seam.*
- 2 *Laser welding of copper or connections thereof, so called hairpins, utilizes the "remoweld®FLEX" to obtain a homogeneous weld seam distribution and sound strength.*
- 3 *"remoweld®FLEX" is equipped with two additional "plug in" modules for an individually designed sensor module. It enables to monitor the seam track and the process using a high speed camera module. The 4 kHz scanner is implemented for high frequency beam oscillation to join difficult to weld materials and combinations.*

Key data "remoweld®FLEX" welding optics

Module

Scanner	<ul style="list-style-type: none"> ■ 2D-scanner up to 4 kHz ■ Laser power up to 4 kW ■ Working distance 150–250 mm ■ Spot sizes 30–600 µm
Camera	<ul style="list-style-type: none"> ■ Frame rate up to 600 fps ■ Lightning unit $\lambda = 808 \text{ nm}$
Sensor systems	<ul style="list-style-type: none"> ■ Triangulation principle ■ Customizable

Connection

- Bus interface
- Integrated PLC control
- Weight approx. 30 kg