Press Release

REMOWELD DBO Opens Up New Possibilities for Modular Large-Scale Aluminum Structures in Automotive Manufacturing

Rethinking Gigacasting: Laser Welding Enables Cast-to-Cast Joining

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Gigacasting is fundamentally changing automotive manufacturing. Instead of joining numerous individual components, manufacturers increasingly produce entire body sections as single aluminum die-cast parts. Researchers at the Fraunhofer Institute for Material and Beam Technology IWS are pursuing an alternative approach: A newly developed laser welding process enables two or more medium-sized die-cast parts to be reliably joined into large structural components, combining the efficiency of large cast structures with greater design flexibility and improved material utilization in production and repair options.

Laser welding can now join cast aluminum directly to cast aluminum. Producing high-quality joints between aluminum die-cast components has long been a major challenge. Process-related pores and gas inclusions in the material can open during conventional laser beam welding. The released gases cause pores in the weld and sometimes violent melt ejections, compromising joint quality. Researchers at Fraunhofer IWS have therefore developed REMOWELD DBO, a new laser welding process. Targeted dynamic beam oscillation widens the keyhole and improves degassing of the molten material. The result is significantly fewer pores, dense welded joints, and reduced melt ejection. This creates new opportunities for modular large-scale structures made from die-cast aluminum. Process-reliable joining of smaller cast components into a large assembly improves material efficiency by enabling manufacturers to use more controllable casting processes and reduce material losses.

“Gigacasting offers significant potential for efficient vehicle production. However, no single design approach can meet every structural and material requirement,” says Prof. Christoph Leyens, Director of Fraunhofer IWS. “Cast-to-cast welding expands the automotive industry’s toolbox. It combines the advantages of cast structures with the flexibility of modular design.” Dr. Dirk Dittrich, Group Manager Laser Welding at Fraunhofer IWS, adds: “Aluminum die casting places high demands on a stable laser welding process. REMOWELD DBO specifically improves degassing of the molten material. This enables us to use cast-to-cast joints for highly

stressed aluminum structures and lays the technological foundation for modular large-scale components."

Large Structures from Multiple Cast Modules

The new joining technology expands the design options available to automotive manufacturers. Manufacturers can assemble large structures, such as battery trays or suspension strut towers, from two or more smaller die-cast parts instead of designing them as a single large casting. This creates new possibilities in both design and manufacturing. Smaller cast components can be tailored more precisely to their individual functions. Design teams can vary geometries, wall thicknesses, and materials within a large structure. At the same time, the modular approach reduces dependence on extremely large die-casting machines.

Modular design also creates opportunities for more targeted material use. Secondary aluminum alloys are becoming increasingly relevant. Modular structures can selectively incorporate their properties without requiring a single material to meet every requirement of a complex, large-scale component. The approach therefore offers potential to increase the share of recycled material in the alloy and reduce the carbon footprint.

Fraunhofer Flagship Project Explores the Car Body of the Future

Fraunhofer IWS further developed REMOWELD DBO for new car body concepts as part of the Fraunhofer flagship project FutureCarProduction. Eight Fraunhofer institutes are pooling their expertise to develop vehicle structures that are environmentally, technically and economically sustainable. The researchers are investigating new casting, forming and joining processes as well as the use of secondary materials. The newly developed holistic assessment method also takes into account material and product quality, repairability, and crash safety.

The Dresden-based institute focuses on laser welding aluminum cast components and hybrid joints within the project. The technology is available for further development and adaptation to specific applications. Automotive manufacturers, die-casting producers, engineering service providers and machine manufacturers can work with Fraunhofer IWS researchers to tailor component geometries, material combinations and welding processes to specific applications.

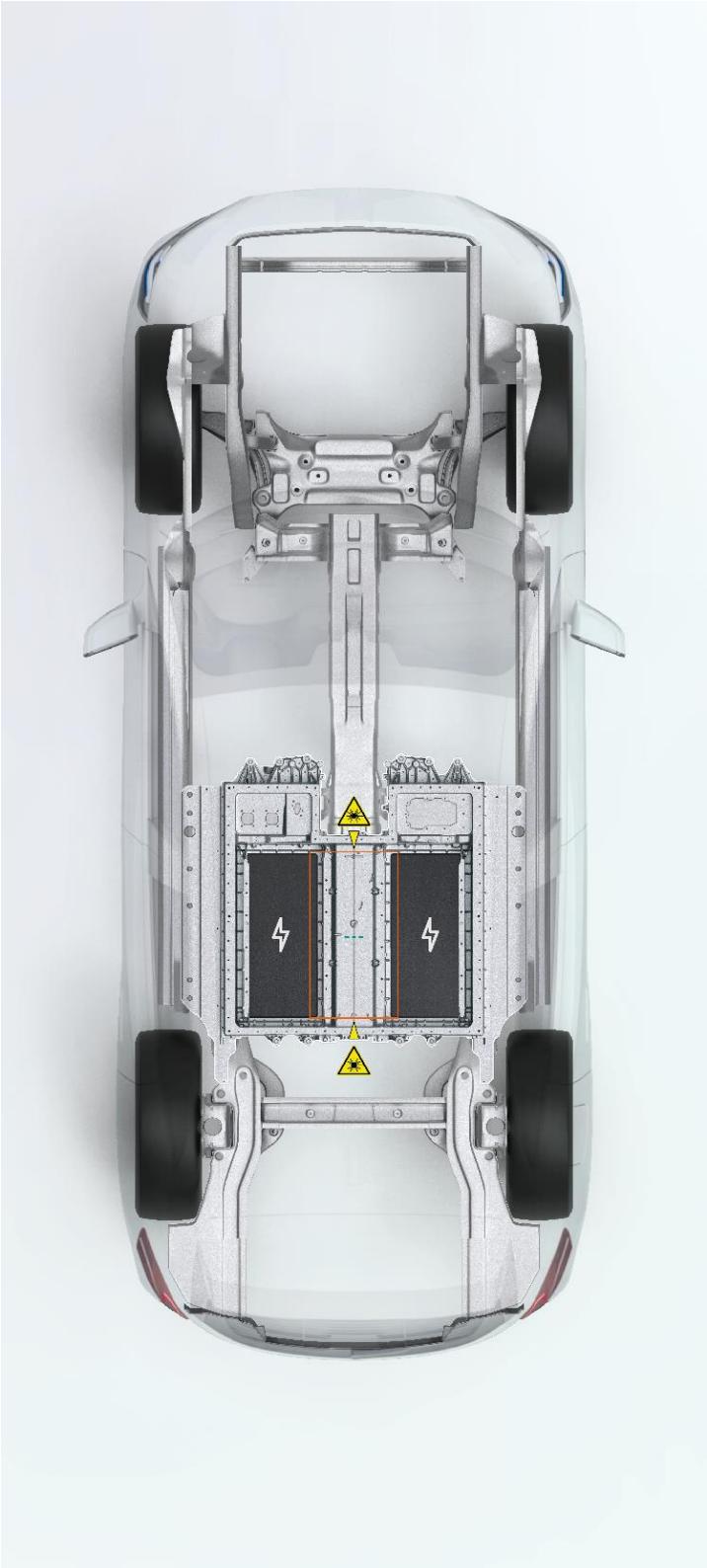
Learn more about Fraunhofer IWS's contribution to the Fraunhofer lighthouse project "FutureCarProduction".

This article was created with the assistance of artificial intelligence. Fraunhofer IWS retained final editorial responsibility.

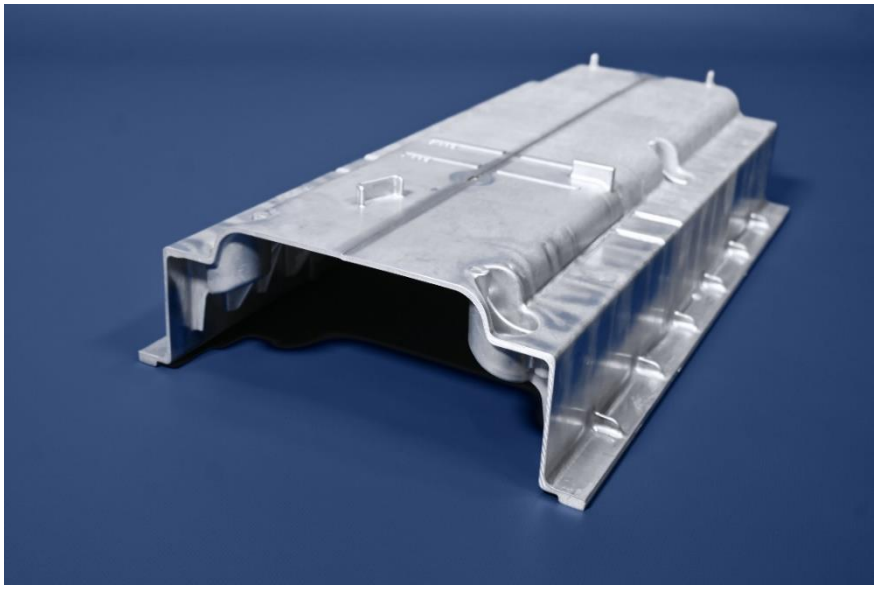
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REMOWELD DBO at a Glance

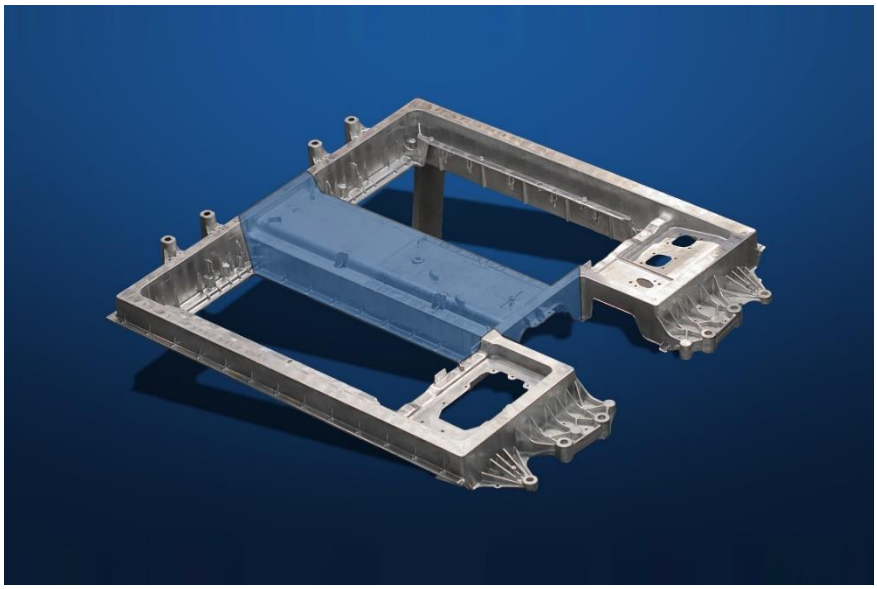
- **Operating Principle:** Dynamic beam oscillation widens the vapor capillary during laser welding, allowing trapped gases to escape more easily from the molten material.
- **Technical benefits:** The process reduces porosity and uncontrolled melt ejection. This produces high-quality, mechanically robust welds between aluminum die-cast parts.
- **Design benefits:** Manufacturers can build large structures from several smaller cast components, replacing giga casting, which requires considerable equipment and material resources. Geometries, wall thicknesses and materials can be tailored more specifically to the respective function.
- **Potential applications:** The technology is suitable for battery trays, front or rear vehicle structures, and other highly loaded aluminum components in automotive engineering.
- **Sustainability potential:** Modular designs reduce the amount of raw material used in casting, facilitate the targeted use of secondary aluminum alloys and open up additional lightweight design options.



Gigacasting gains flexibility: A new laser welding process by Fraunhofer IWS combines the efficiency of large-scale aluminum die-cast structures with greater flexibility in design, production and repair.
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The aluminum die-cast component demonstrates the feasibility of the newly developed laser welding process; the weld is visible at the component's top center.
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A reliable welded joint enables large structural components to be assembled from multiple aluminum die-cast parts; the weld is located within the light blue section.
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