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Doing more with less – Lightweight constructions by hybrid joints

Joining of completely novel material combinations, new construction principles, and production processes guaranteeing high quality – these are the challenges to which enterprises and the scientists at Fraunhofer IWS have been standing up for years. Parts and assemblies are expected to be possibly light, strong, durable and reliable. The application of hybrid joints between metals and reinforced composites in the automotive, aerospace and many other areas are a new trend, which is significantly swayed by Fraunhofer IWS Dresden, and is presented at EuroBLECH 2016.

Multi-material systems with tailored materials combinations are the key for resource-efficient lightweight solutions for future transportation systems. In the automotive as well as in the aerospace industries the trend in novel materials points towards material compounds.

Thereby, suitable materials are combined in order to use their advantages according to strain. In many innovative constructions metallic inhomogeneous parts (e.g. steel-aluminum) as well as atypical hybrid structures (metal-fiber plastic composites) come into operation.

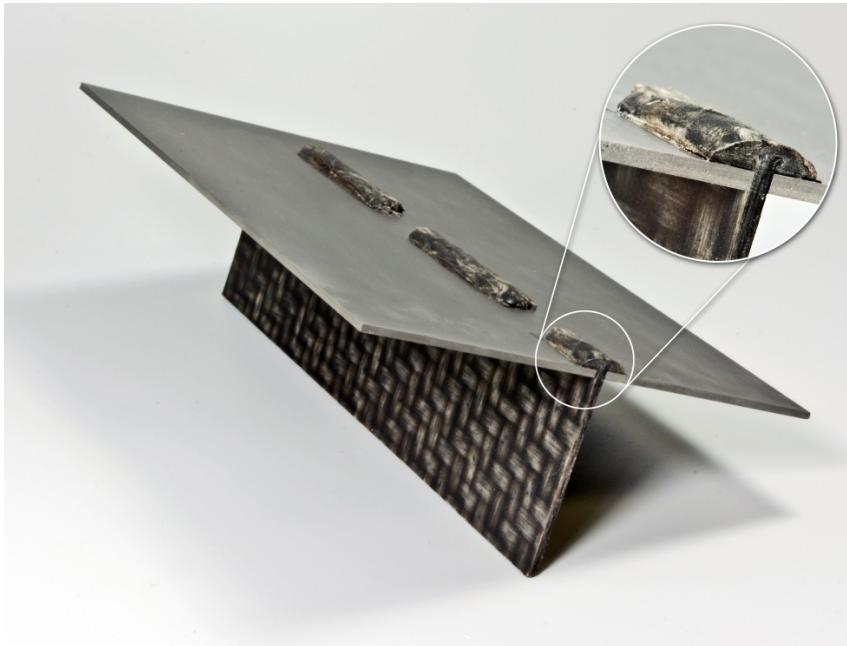
Joining of such hybrid compositions, which is much more difficult than in monolithic constructions, poses a huge challenge. Depending on the joining partners, a specifically adapted concept which considers the materials and which is suitable for production is needed, in order to produce reproducible joints with sufficient quality and load-bearing capability.

The scientists at Fraunhofer IWS Dresden have already developed the slot-tap design principle for form fit and adhesive bond joining of two metal sheets and have achieved hereby a significant reduction in weight. They use now their expertise in joining of fiber reinforced thermoplastics (organic sheets) with metals. The organic sheet builds the tap whereas the metal sheet is the slot sheet. In the joining process a laser is used as well. A fiber laser allows a very finely adjustable and controllable heat supply of the fiber reinforced tap sheet. The two-dimensional high-frequency beam deflection by means of a scanning optics allows a homogeneous heating of the plastic material. The correct heating regime guarantees here the quality of this sensitive process.

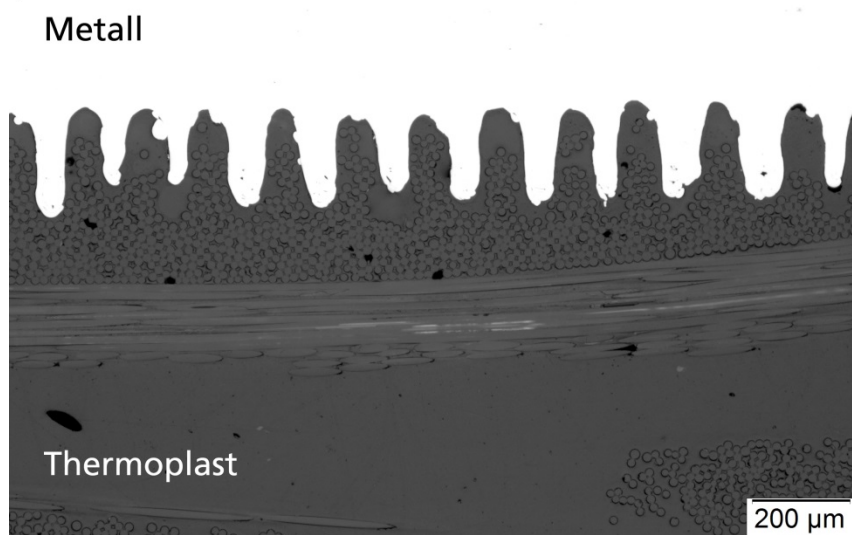
The laser is also used for the thermal direct joining of metals and organic sheet for overlapping joints. On the side of the metal the joint patch is structured with a laser. The heating is carried out also by a laser. Form fit and adhesive bond joints on the microscopic level show the same or even higher stability as pure adhesive joints.

We are going to offer first impressions and present the prospects of works at the trade fair **EuroBLECH from October 25 – 29, 2016 in Hannover**. Visit us at the **Fraunhofer stand in hall 11 / B135**.

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A slot-tap joint produced by thermal joining (hybrid joint) of a metal sheet and a fiber reinforced thermoplast
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Cross section of an overlapping joint produced by thermal direct joining between a metal sheet structured by laser microstructuring and a glass fiber reinforced thermoplastic material
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Contact:

Fraunhofer-Institut für Werkstoff- und Strahltechnik IWS Dresden
01277 Dresden, Winterbergstr. 28

Business Unit Joining

Dr. Jens Standfuß

Phone: +49 351 83391-3212

Fax: +49 351 83391-3210

E-Mail: jens.standfuss@iws.fraunhofer.de

Public Relations

Dr. Ralf Jäckel

Phone: +49 351 83391-3444

Fax: +49 351 83391-3300

E-Mail: ralf.jaeckel@iws.fraunhofer.de

Internet:

<http://www.iws.fraunhofer.de> und

<http://www.iws.fraunhofer.de/de/presseundmedien/presseinformationen.html>