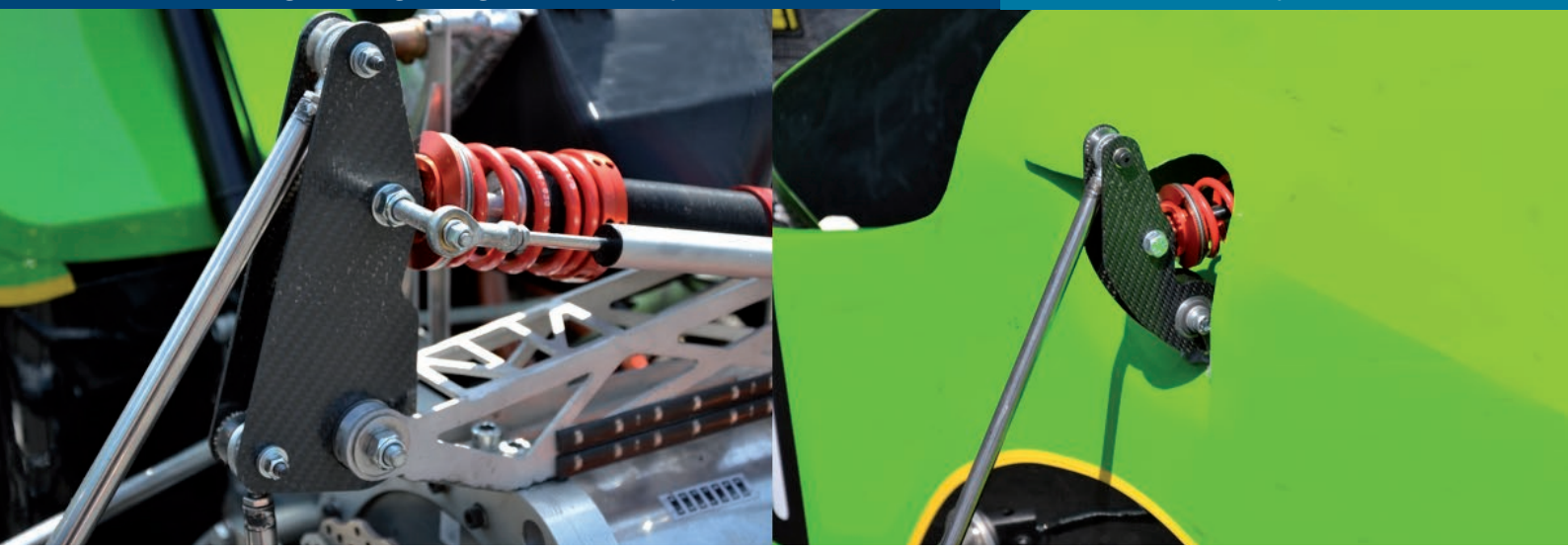
Federal Ministry
for Economic Affairs
and Climate Action

Best practice example

for lightweighting in Germany

Plastic/metal hybrid composite



Fibre-reinforced plastic/metal composite for use in vehicle construction

Laser-based joining of plastic/metal hybrids

Fields of application

Automotives | Machinery and plant construction | Commercial vehicle manufacturing | Aircraft construction | Manufacture of other vehicles

In this example, lightweighting allowed for the following reductions compared to a mixed design with insertion elements:

KG Weight approx. -25 %

Application

The targeted use of this functional material in the relevant place allows for massive weight reductions in vehicle construction. Combining materials with different properties, especially fibre-reinforced plastic and metals, opens up maximum potential for realising the lightweighting requirements that have arisen in the context of electric mobility.

Challenge

Forming a direct composite of the two materials is only possible if the joining process is adjusted to the specific properties of both materials. The resulting hybrid composites must live up to the usual standards that apply for components placed under high levels of dynamic stress, or even offer advantages over competing procedures.

Solution

Thermal joining involves the heating of the metallic joining partner by means of laser radiation. At the melting zone, this metallic partner is then firmly combined with the other material made of plastic. Adjusted process design allows for high degrees of rigidity to be achieved in short-time and fatigue tests. The innovative joining process also opens up completely new construction methods, e.g. the chassis component illustrated above.

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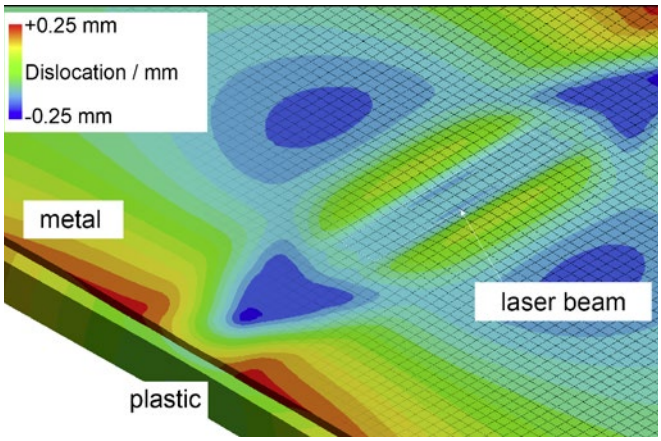
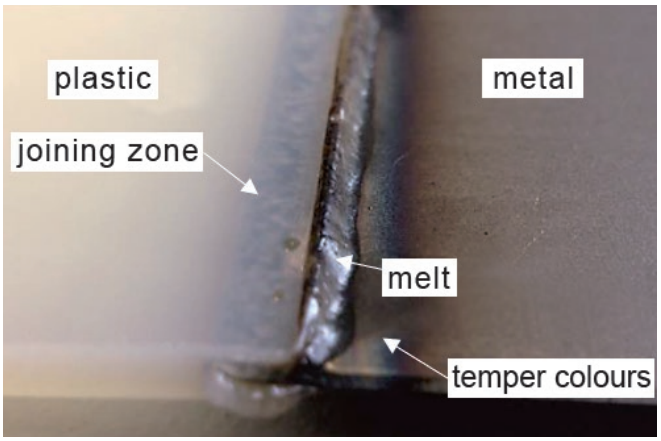


Thermal/mechanical simulation of the joining process



Hybrid composites in butt joints for tubular components

Other potential applications

Electronics industry

Construction of rolling stock

Medical technology

Further work conducted on the basis of numerical simulations and the analysis of materials will make it possible to transfer the method to other combinations of materials and to innovative components and structures, e.g. for use in machinery and plant construction or in home appliances. This also allows for additional aspects, e.g. warpage, to be taken into account.

The promising outcomes of further tests into environmental conditions, e.g. alternating climate test and thermal stress, highlight the major potential that plastic/metal hybrids can offer for numerous applications and industries.

Beyond this, other joining geometries, e.g. butt joints, can also be achieved once the technologies have been adjusted.

Compliance with all requirements relevant for the sector is being ensured. Research activities are being conducted so as to further improve health and safety, environmental protection and recycling.

The LIGHTWEIGHTING ATLAS

The LIGHTWEIGHTING ATLAS is an interactive web portal that pools information on those active in lightweighting and their skills across different industries and materials. The atlas is free to use and entries into the atlas are also free. You can find the LIGHTWEIGHTING ATLAS at www.leichtbauatlas.de

The Lightweighting Initiative

Modern lightweighting is of pivotal importance for German industry and its competitiveness. Federal Ministry for Economic Affairs and Climate Action has established the Lightweighting Initiative to support lightweighting in Germany. The Lightweighting Initiative Coordination Office in Berlin, which is financed as part of the initiative, pools all activities relevant to lightweighting and supports German companies, especially SMEs, as they implement lightweighting.

Contacting the Lightweighting Initiative Coordination Office

André Kaufung
Director of the Coordination Office Tel.: +49 30 2463714-0
Fax: +49 30 2463714-1
Email: gsl@initiativeleichtbau.de
www.initiativeleichtbau.de

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