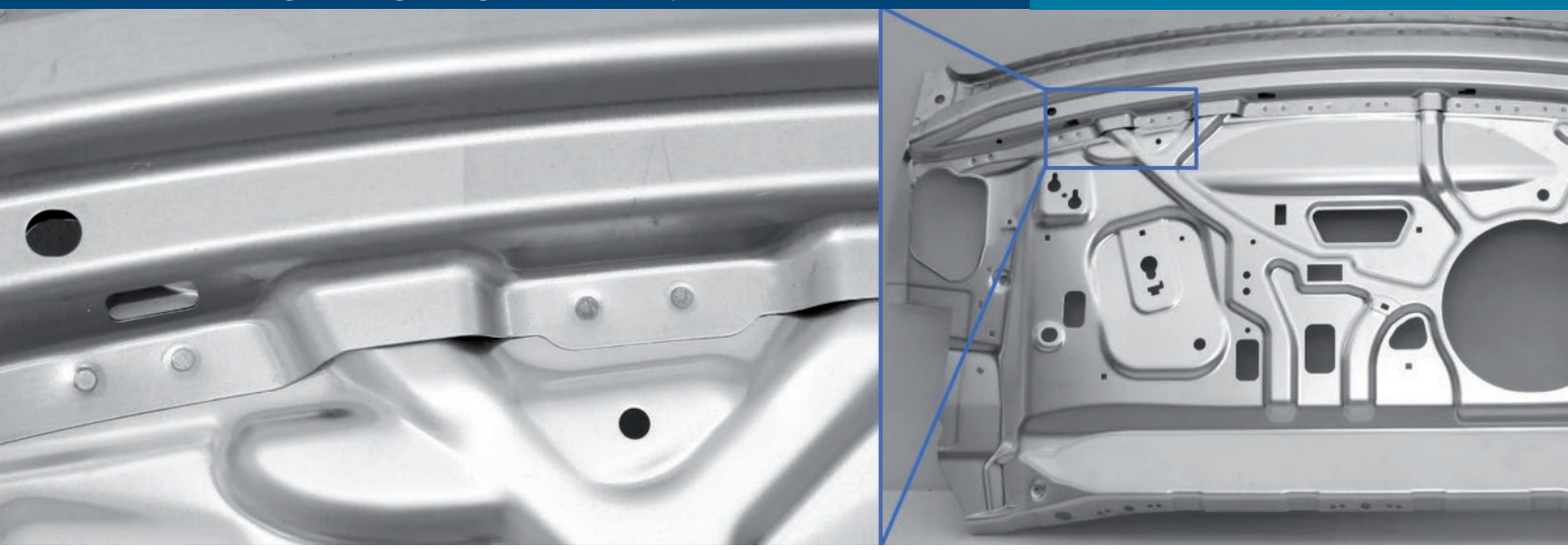
Federal Ministry
for Economic Affairs
and Climate Action

# Best practice example

for lightweighting in Germany

Aluminium/steel composite



Aluminium/steel composite used in vehicle manufacturing

## Unilateral resistance-based joining of aluminium and steel

### Fields of application

Automotives

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

Weight approx. -100%  Production time approx. -50%

### Application

Combining aluminium and steel is essential to lightweighting and especially in many aspects of vehicle manufacturing, where it allows for functional materials to be used where they are needed. The development of a suitable joining technique for this is of utmost importance for ensuring that this is economically viable at an industrial scale.

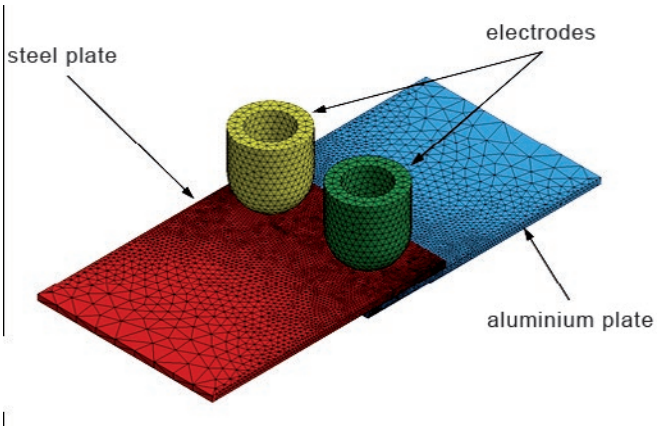
### Challenge

The formation of intermetallic phases requires the temperatures of both materials to be managed precisely, so as to achieve a solid, but ductile composite made of aluminium and steel. The use of new joining techniques must make technological as well as economic sense. Barriers to entry ought to be minimised by ensuring that the new technology is based on existing installations.

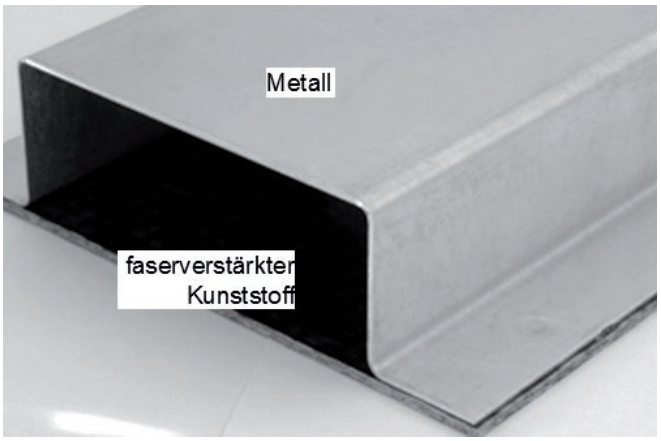
### Solution

The development of unilateral, resistance-based joining allows for temperatures to be controlled exactly so as to allow for bonding between aluminium and steel to take place whilst limiting the formation of intermetallic phases. It proved possible to validate the joining process for a serial component made of steel and aluminium that is used in vehicle manufacturing.

## Best Practice Example | Aluminium/steel composite




Understanding the process with the help of numerical simulation




Thermal joining of plastic and metal

## Other potential applications

Other Vehicle manufacturing

Rolling stock vehicle manufacturing

Commercial vehicle manufacturing

Aircraft construction

Further work conducted on the basis of numerical simulations and the analysis of materials will make it possible to transfer the method to other metallic alloys and to innovative components and structures, e.g. for constructions based on tubular components.

Beyond this, it will also be possible to use this process for new combinations of materials. The focus will be on composites made of plastic and metal. There is a wide field of application across different industrial sectors, ranging from household appliances to aviation. It is possible to safely and securely join these various materials together using this method, regardless of their different properties.

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. The 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.

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