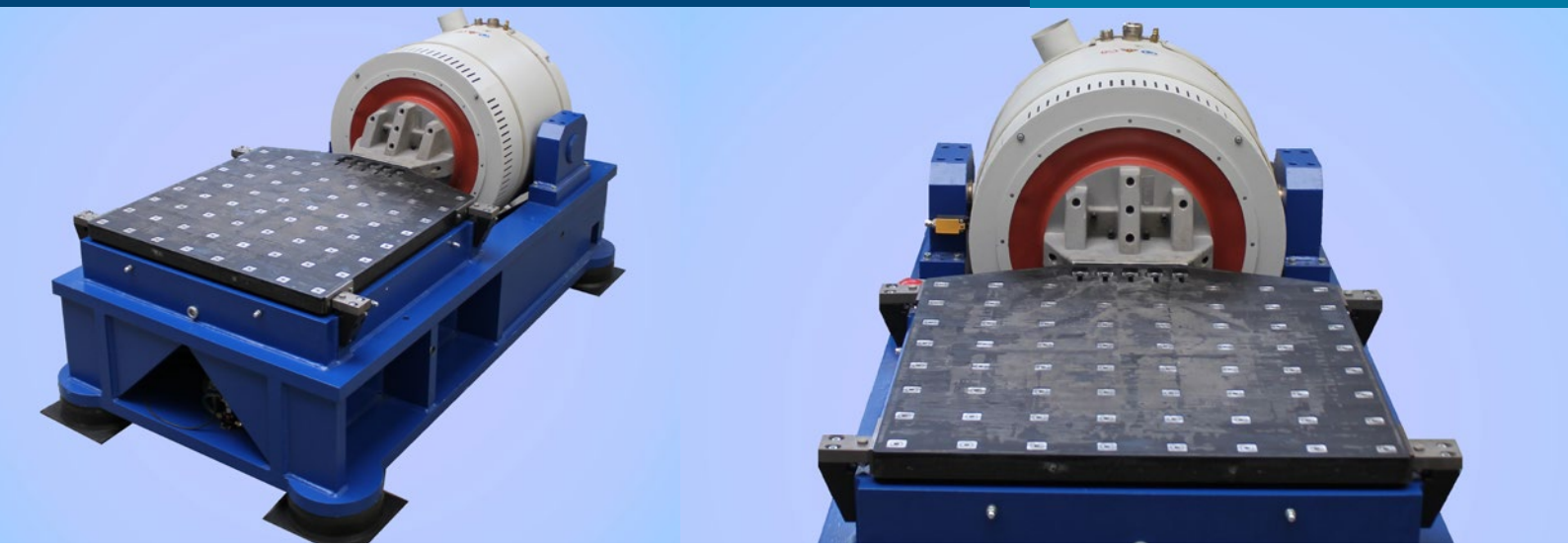
Federal Ministry
for Economic Affairs
and Climate Action

Best practice example

for lightweighting in Germany

CFC/aluminium foam



Vibration test system incorporating a CFC/aluminium foam sliding plate

Mass reduction through a sandwich construction using CFC/aluminium foam

Fields of application

Automotives

Machinery and plant construction

Aircraft construction

In this example, lightweighting allowed for the following reductions compared to a conventional model made of magnesium:

Weight approx. -35 %

Energy approx. -80 %

Cost approx. -20 %

Application

A sliding plate made of (solid) magnesium is used for clamping samples to be tested in a vibration test system operating within the frequency band between 5Hz and 3,000 Hz. The objective is to test samples' properties under horizontal, dynamic stress.

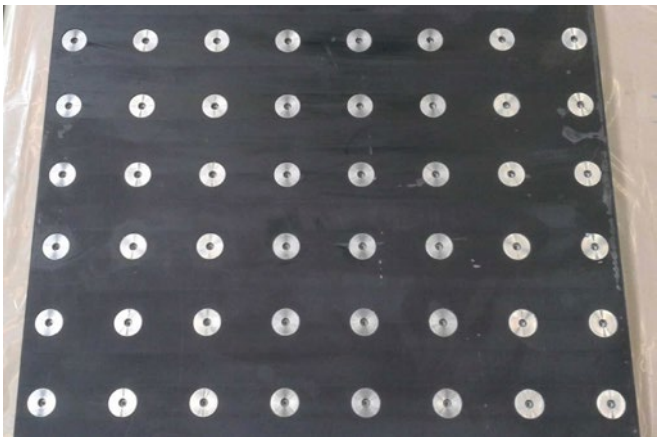
Challenge

A sliding plate made of (solid) magnesium is to be replaced with a sandwich composite made of carbon fibre-reinforced plastic (CFC) and aluminium foam, whose dynamic behaviour in the frequency band of 5Hz and 3,000Hz is optimal. A second goal was to implement replaceable connecting elements for mounting the test samples with screws. The objective was to achieve a reduction in mass of 30%.

Solution

The use of fibre-reinforced plastic – in this case also combined with aluminium foam – allows for the sliding plate to be especially adjusted to known load cases. This requires detailed knowledge of the exact demand placed on the sliding plate and of the stress affecting the connecting elements (thread insert integrated into the magnesium).

Upper side of the CFC/aluminium foam sliding plate (clamping surface)



Lower side of the CFC/aluminium foam sliding plate (glide surface)

Other potential applications

Commercial vehicle manufacturing

Rolling stock construction

Shipbuilding

Logistics

Spacecraft vehicle manufacturing

Other vehicle manufacturing

Once the exact demand criteria in terms of stress had been calculated, the sandwich component was designed, suitable combinations of materials identified, and new connection elements developed. The latter meet the requirement of being replaceable and of establishing a frictional connection within the fibre-reinforced plastic. It proved possible for the new CFC/aluminium foam sliding plate to meet 100% of the requirements in terms of dynamic stress. The reduced mass of the sliding plate, with otherwise unaltered properties, now makes it possible to use more energy-efficient drive technology to power it. The insights gained into the feasibility, cost efficiency and energy efficiency of the technology were further expanded in a follow-up project.

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.

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