GESAMTVERBAND DER ALUMINIUMINDUSTRIE e.V.

New process joins sheet metals better together

Scientists at the University of Stuttgart have developed two new variants of friction stir welding. For the first time this will make it possible to use the friction stir welding process to efficiently and strongly join steel or aluminium sheets of different thicknesses. It will allow an up to 100 percent increase in the ability to exploit thin steel sheet materials in hybrid aluminium-steel car bodies. TLB GmbH has been commissioned to implement the technology economically worldwide on behalf of the university.

Due to their different strengths, steel and aluminium are often used in different thicknesses. That is why producing high-strength joins of these materials is a fundamental problem in industrial joining technology. To date, joins between dissimilar materials of different thicknesses have been achieved by lap welding, because it is a method that can achieve good bending moments and tensile strengths. But it can also produce disruptive edges. On top of that, the direct combination of different materials and the gaps resulting from overlapping produce an increased risk of corrosion.

With the friction stir welded joints developed at the Institute for Materials Testing, Materials Science and Strength of Materials (IMWF) at the University of Stuttgart it is possible to produce efficient and high-strength joins of steel and aluminium sheets of different thicknesses.

The engineers and technicians Prof. Dr. Ing. Stefan Weihe, Martin Werz, Max Hoßfeld and Oliver Volz researching at the IMWF and the MPA Stuttgart (Materials Testing Institute University of Stuttgart) developed two process variants with which two sheets of different thicknesses could be joined for the first time as butt joint. The joints demonstrate very high levels of tensile strength and fatigue behaviour.

In one of the process variants the steel sheet is folded in a way that its join cross section for joining to the aluminium sheet is doubled in the region of the join. This increases the cross section of the thinner, stronger sheet at the join position, which allows the softer aluminium to join to the steel across the entire surface of its cross section.

In the second process variant developed at the University of Stuttgart, using a newly developed tool it is possible to produce a combined lap/butt joint in one welding operation. The resulting joint surface more than doubles compared to conventional butt joints. The enlarged joint area and the aluminium's high yield strength produce excellent structural and cyclical joint strengths.

When joining such materials typical for cars with the new processes, joint strengths of up to 99.4 percent of the steel sheet can be achieved. This way, the newly developed welds can save materials while simultaneously raising the level of safety for vehicle

occupants in cases of accidents. And the newly developed processes raise efficiency in the welding process itself: they require fewer work steps and less energy.

Your contact:

Georg Grumm
Information und Communication

Gesamtverband der Aluminiumindustrie e.V.
Phone: + 49 211 47 96 160
E-mail: georg.grumm@aluinfo.de