

Improved formability of aluminum and steel Tailor Welded Blanks (TWB) during friction stir welding

Tailor welded blanks are already widely used in mechanical engineering, e.g., in the manufacture of vehicle bodies, for which the lightest possible, high-strength and at the same time crash-proof, i.e., robust materials are required.

- Process-reliable forming of TWB made of aluminum
- and steel or aluminum-aluminum combinations
- Only additional artificial aging
- at relatively low temperatures
- No solution annealing required
- No more tool modification (punch) necessary
- Higher weld seam reliability during operation



Fields of application

The process is used to form Tailor Welded Blanks (TWB) made of aluminum and steel.

Background

Tailor welded blanks are already widely used in mechanical engineering, e.g., in the manufacture of vehicle bodies, for which the lightest possible, high-strength and at the same time crash-proof, i.e., robust materials are required. Aluminum provides excellent possibilities for weight reduction and has good material properties. It is an essential material of future automobile manufacture. However, the combination of steel and aluminum in Tailor Welded Blanks poses specific problems for manufacturers and users, in particular around the weld seam.

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Development Status

TRL3 - Proof of function

Patent Situation

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16/121TLB

Service

Technologie-Lizenz-Büro GmbH has been entrusted with the exploitation of this technology and assists companies in obtaining licenses.

Problem

In order to meet structural requirements and achieve low weight, it would often help to make components from aluminum sheets of different thicknesses, different alloys or sheets that also contain other materials such as steel. The joining and further processing of such Tailor Welded Blanks (TWB) is, however, not trivial and the formability of the weld seam is often severely limited as cracks can form. This is why to date TWB has not been widely used.

Solution

The procedure developed at the University of Stuttgart essentially comprises two treatment steps that are carried out in a specific time sequence. On the one hand, natural aging, which can be implemented without additional expense into the production process, and on the other hand, local artificial aging of the weld seam or the entire TWB. The aim is to strengthen the weld seam before forming the TWB so that strain localization around the weld seam is avoided and overall formability of the TWB is increased. In the new process, welding of the plates replaces solution annealing of the TWB, which results in reduced costs. This method opens up completely new fields of application while ensuring a high level of process reliability when using aluminum-aluminum TWB and aluminum-steel TWB.

In tensile tests, EN AW 6061 (T4) with appropriately treated weld seams proved the suitability of the method.



Formed TWB of aluminum and steel (EN AW6111 + DX54) [Photo: University of Stuttgart]