



WELDING HIGH-MANGANESE STEELS IN DISSIMILAR COMPOUNDS

Task

High-manganese austenitic steels are characterized by a high plasticity and an increase in strength when they are cold formed. This makes them ideal candidates for lightweight construction. Despite their high carbon content, these steels prove suitable for welding, whereas the weld seams have a high degree of deformation. The combination with other standard materials and ultrahigh-strength grades of steels should be examined from a technical and welding-based perspective.

Method

The project shall examine the weldability of dissimilar compounds with 1.4678, cold worked to 1100 MPa (H1100), on the one hand, and 1.4301 (X6CrNi18-10) or hardened 1.4034 (X46Cr13), on the other. As a part of the investigation, the effect of autogenous laser welding shall be tested, without pre- and post-heating, on seam geometry, mixing behavior and hardness.

1 Butt joint 1.4678/1.4301.

2 Butt joint 1.4678/1.4034.

3 Lap joint 1.4678/1.4301.

4 Lap joint 1.4678/1.4034.

Result

The cold-formed manganese steel loses strength in the cast structure of the welding seam. In conjunction with the metastable 1.4301, a smooth transition of strength can be achieved in the butt joint. In the lap joint, the strength is maintained in the connection zone since martensite is partially formed as a result of mixing. In connection with the hardened 1.4034, a drastic loss of hardness occurs. This is due to the dilution with manganese, whereby the formation of soft austenite is promoted. The basic investigations show that a welding of the above combinations is possible in the thin-sheet range. Whether and how far the strength can be produced by heat treatment or stress again is being examined as the work continues.

Applications

The process can be used wherever an application can take advantage of the combination of high elongation and high strength with predominantly static loading. For example, web-core sandwich panels may be constructed of steel with improved damping properties. Due to the narrow welding seams, further constructive possibilities exist, but whose potential has yet to be explored.

Contacts

Dipl.-Ing. Martin Dahmen
Telephone +49 241 8906-307
martin.dahmen@ilt.fraunhofer.de

Dr. Dirk Petring
Telephone +49 241 8906-210
dirk.petring@ilt.fraunhofer.de