



ANALYSIS OF LASER BEAM WELDED ULTRA-HIGH-STRENGTH DUAL-PHASE STEELS

Task

When dual-phase steels with strengths of 980 and 1180 MPa are laser welded, subcritical failure and localized deformation in the heat affected zone restrict their usability. By analyzing the thermally influenced zones, research can help understand the causes as well as contribute to defining corrective measures.

Method

As part of an error analysis, Fraunhofer ILT determined that annealing effects cause the material to weaken in the heat affected zone. At the same time, carbide precipitates strengthen the material in some areas. This development aimed to raise the minimum hardness in the heat affected zone and increase tempering resistance. In addition, an attempt was made to minimize the width of the annealing zone.

Results

When the process parameters as well as the alloy range are adjusted to increase the critical temperatures, the width of the weakened area can be minimized. The positive effects can be supported by design features in order to shift critical points to less loaded positions.

Applications

The extended findings on the causes of failure can be applied to all weldable martensite-phase steels. This makes the know-how available for welding production in a wide range of applications, from vehicle construction for road and rail to structural steel construction.

Contact

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

- 2 Weld seam in S500MC/DP980 after buckling-bending load in the forming tool.
- 3 Fracture edge of a tensile specimen of DP1180 with micro voids elongated in the direction of flow.