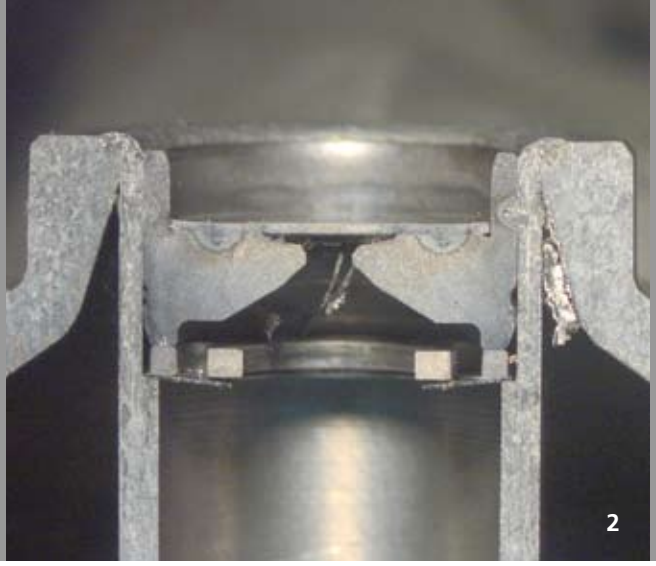

LASER WELDING OF CARBAMIDE INJECTORS

Task

Carbamide is injected into exhaust tracts of diesel aggregates to reduce nitrogen oxides. For the manufacture of suitable injectors, several components have to be mounted and welded in different joint configurations (fillet, i-seam and overlap) in various working material combinations. In total, four different welding tasks are affected in this manufacturing process.

Method

Due to the small number of pieces when a series production is started, a complex automated production line is not profitable for the manufacture of these components. To evaluate the process capability, an optical set-up (optical fiber core diameter, collimation, focusing optics, beam source), identical for all welding tasks, was selected and mounted in a flexible portal machine with a laser scanner. The variable parameters (focus positioning, power, welding speed) were adapted to the particular requirements for the joining task in question. The strength properties attained in the tests were used to evaluate process capability indices. When the seams are dimensioned appropriately to reach high capacity indices, testing costs can be reduced and costs resulting from errors avoided.

To ensure the quality, the process capability was shown for the welding processes developed. In addition to the tension or shear strength that had to be reached, tightness and stability of the connection width, or the welding depth, were also relevant. Laser beam welding was identified as the most suitable welding process because it offers short processing times, reduces heat input and welds with small seam dimensions.

Result

For the manufacture of carbamide injectors, a process (c_{pk} >> 1.67) using an optical set-up common to all four joining tasks could be established, which is currently being used to produce in small series. Thanks to the high capability indices, the costs and efforts for testing (in process development and series manufacture) could be limited significantly.

Applications

The results of the welding process development illustrate the possibilities and the flexibility that a laser system offers in a non-automated plant with manual fitting. Due to a suitable dimensioning of the welding processes and, thus, the seam properties resulting from this, costs resulting from errors and testing can be reduced.

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1 View of a weld bead between carbamide injector and heat sink.

2 Cross-section of the weld seam shown in Figure 1.

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DQS certified by DIN EN ISO 9001, Reg.-No.: DE-69572-01