Investigations on Seam Quality in Laser Beam Welding of Contaminated, Zinc Coated Sheets

A. Blankl[a] and M. Geiger[b]

Chair of Manufacturing Technology; Egerlandstr. 11; D-91058 Erlangen; Germany

[a]a.blankl@lft.uni-erlangen.de, [b]m.geiger@lft.uni-erlangen.de

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Abstract. The customers' demand for high quality and low cost products with rising functionality forces the enterprises to cost savings. In production these cost savings can be accomplished by simplification or omission of handling operations in the process chain. In laser beam welding of stamped sheet metals a previous cleaning of the sheets is usually necessary to guarantee a sufficient seam quality at a lap joint. Due to the recent trend towards low use of lubricants in forming operations the question arises, whether this process could be avoided in order to lower the production costs. The disadvantage of this measure would be a degradation of the seam quality. This reduction shows up in a falling strength of the weld due to inclusions and pore formation.

This paper deals with the impact of different types of contaminations on the quality of laser welding. Therefore several liquid (oils) and solid (metallic and non-metallic) contaminants are examined. Zinc coated sheets are investigated too, because a zinc contamination arises with these sheets in the welding operation. The zinc coating evaporates because of the high temperature and this leads to a high porosity in the welding seam. In both cases also the height of the gap between the two sheets is varied in order to investigate its influence on the weld. To reduce the effort of the investigations, but not the accuracy of the results, the laboratory trials were supported by the methods of design of experiments. After the welding operation, the quality of the welding seam is evaluated by means of its mechanical properties and tightness. The results of the investigations are discussed and the developed solution strategies are presented.