DFG-Project Schmauder 746/134-1

Experimental investigation and FE simulation of ductile fracture of aluminium alloy laser welded butt joints

Project begins: 01. April. 2013
Project end: 31. March. 2015

Aim:

In this project, the Rousselier model is adopted to study the crack growth of an Al6061 laser welded butt joint. Based on hardness tests across the welded joint, three different weld regions are defined, i.e. the base material (BM), the fusion zone (FZ) and the heat affected zone (HAZ). Local mechanical properties are derived from tensile test results of flat specimens extracted from these weld regions. Metallographic investigations are performed on BM, FZ and HAZ, respectively, to obtain size, shape and frequency distribution of non-metallic inclusions. The object grading technique (ARAMIS) is used to capture the deformations at the surface of flat specimens with the weld seam located in the centre. The numerical work is divided into three parts: The first activity is to calibrate the Rousselier parameters based on metallographic investigations and tensile test results of notched round bars. The second activity is to predict ductile crack growth in compact tension (C(T)) specimens and to derive the corresponding stress and strain levels of flat specimens during the tensile process by applying the same Rousselier parameters obtained in the first part. The third activity is to predict the final fracture of transverse flat specimens including Lüders band propagation. The aim is to apply the Rousselier model taking Lüders band propagation into account to describe ductile fracture, to predict the mechanical behaviour of laser welded joints reliably and to improve the design of laser weldments.

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