Success Story
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metal JOINing

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K-Project Network of Excellence for Metal JOINing
Programme: COMET – Competence Centers for Excellent Technologies
Programme line: K-Projects
COMET subproject, duration and type of project:
P3 - Chain, 09/2014 – 09/2018, multi-firm

Modelling of the flash formation in LFW of chains

The steps to understand the mechanisms responsible for flash formation and removal of surface contaminants in linear friction welded chains were studied. To that end, 2D computational modelling was considered using the finite element analysis (FEA) software DEFORM and was divided in two distinct approaches: a purely thermal model and a plastic flow model. Regarding the thermal model, temperature measurements using K-Thermocouples were performed to validate the proposed model.

Modelling

A thermal model was used to estimate the heating during the initial phase. A uniform heat flux was applied across the interface and linearly reduced to 50% of its value 2 mm away from the edge, which corresponds to the amplitude of the process. The input in the weld interface per phase can be computed by the product of the force at the weld interface and speed at a given instant. Also, a plastic flow model is used for the equilibrium phase, to which it is assumed total contact of the interfaces of the workpieces, thus one plastic work piece is assumed. The model was thermo-mechanically coupled.

Experimental validation

Figure 1 presents the comparison between the thermal model and thermocouple recordings during the initial phase of the process and satisfactory agreement between the experiments and model was obtained. This means that the thermal profile can be used as input for the mechanical model calculating the plastic flow. The plastic deformation that occurs in the initial phase of the process is not taken into consideration in the model.

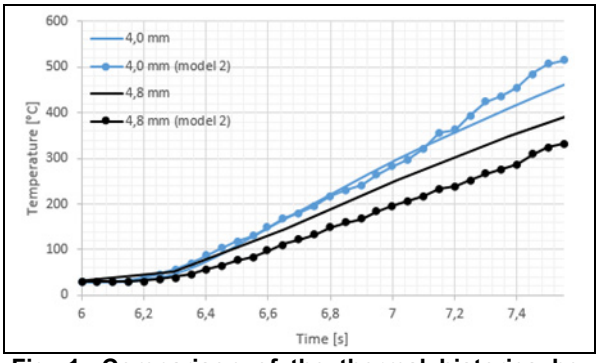

Fig. 1: Comparison of the thermal histories between the experiments and model at 4 mm and 4.8 mm from the interface

Impact and effects

This FEA proves to be useful to understand the mechanisms behind flash formation

bmwfw Bundesministerium für Wissenschaft, Forschung und Wirtschaft
bmvit Bundesministerium für Verkehr, Innovation und Technologie

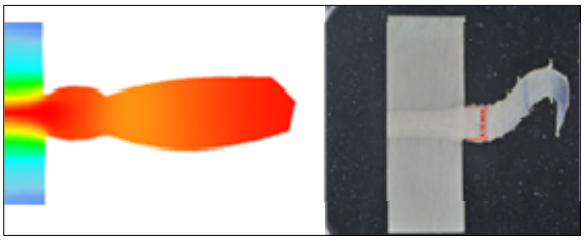

Fig. 2: Flash formation: comparison between FEA and experiments

Figure 2 shows a comparison between the flash morphology of the FEA and the experiments. The smooth appearance of the flash is a result of a relatively wide heat affected zone (HAZ) and low oscillation amplitude, thus no separation between the flash and edge of the workpiece occurs. Hence, it is intimately related to the welding parameters used. Also the experimental flash is bent in relation to the numerical model due to the interaction between the expelled material and the tooling.

To sum up, this approach allows to understand the influences of the welding inputs on the flash generation as well as other outputs.

Contact und information

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