Sandwich Collars

Hole-Flanging of Sandwich Sheets

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Abstract

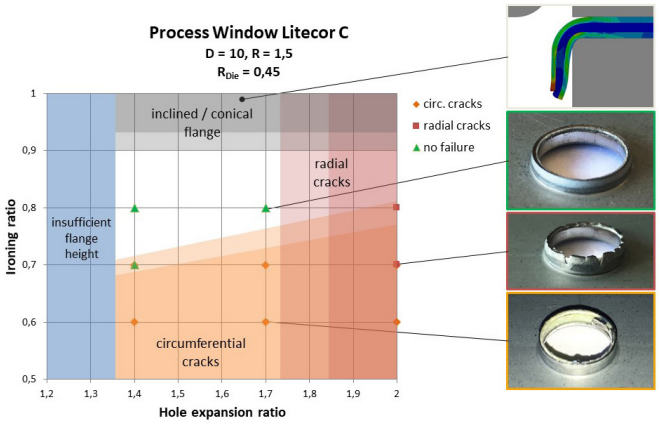
In this project, hole-flanging was used to create stiffened joints in sandwich sheets, to be used for downstream joining processes. The goal was to develop a process understanding for the hole-flanging of sandwich sheets and to derive design guidelines to enable the robust and economical production of joints in sandwich sheets.

Project description

Modern semi-finished products such as sandwich sheets achieve lightweight construction through load-optimized component design at the material level. However, the wide range of different mechanical and physical properties that are combined in a single part made from those modern composite materials presents new challenges for established manufacturing processes. In particular, conventional joining processes can only be applied to a limited extent or with increased effort.
The objective of the present research project was the investigation of hole-flanging as a possibility to produce stiffened joints in sandwich sheets. This was done using experiments and supplementary simulations.

Results

For the experimental investigation, an existing tool for counter shear cutting, which has a kinematic similar to hole-flanging, was modified. The tool was designed modularly in order to realize a quick and easy variation of its geometry. In extensive test series and supplementary simulations, process windows for two different sandwich sheets were determined.
The achieved limit expansion ratios are lower than those of conventional sheets, but sufficiently high flanges can be realized for many applications. In addition, large punch radii, large die radii and the use of a counter punch were identified as feasible ways of extending the process limits.
Concepts for the connection between two sheets or one sheet and a solid element were developed, produced and assessed with regard to their joint strength. It was shown that stiffening effect of the hole-flanges has a positive influence on the joint strength and creep behaviour.



[1] Exemplary process window for DPunch = 10 mm, RPunch = 1,5 mm und RDie = 0,45 mm. Experimentally produced hole-flanges (data points) and numerically estimated process limits (colored areas) are shown

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