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Deformation mechanism and process optimization of mechanical clinching joining technology used for steel and aluminum alloy sheets

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ABSTRACT

With the high demand of automobile lightweight, the mixing application of multi materials in automobile bodies becomes a must. Therefore, the joining of these multi materials with different properties turns to be a problem. In this context, the mechanical clinching, as a newly developed technique, has significant application prospect.

In this paper, the deformation mechanism and process optimization of mechanical clinching joining technology are studied. The finite element model of steel–aluminum alloy mechanical clinching is established. The effects of different placement orders of sheets and the key process parameters of dies on the forming results of mechanical clinching are discussed. Numerical simulation and experiments are performed to predict the connection strength of steel–aluminum alloy mechanical clinching joint. The result shows that the finite element analysis results are in good agreement with the experimental ones. The deformation mechanism of steel and aluminum alloy sheets during this process is then analyzed.

KEYWORDS: mechanical clinching, finite element simulation, deformation mechanism, process optimization, connection strength