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Push-bending process of stainless-steel tubes: experiment and simulation

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ABSTRACT

The push-bending process of stainless-steel tubes was investigated by using the experimental method and finite element (FE) analysis based on the commercial software MSC.MARC. The effects of the processing parameters and the lubricating condition on the forming quality of as-obtained ASTM304 tubes were discussed. The results demonstrated that the experiment results were consistent with the simulation both in deformation behavior and the stress distribution during the push-bending process, which verified the reliability of the established FE model. The results also show that the maximum residual stress concentrates in the middle of tubes, the maximum residual strain on both internal and external side increases first, and then decreases. After the push bending, the interior wall thickness increases, whereas the exterior wall thickness decreases. When the relative bending radius is larger, the more springback, the smaller ovality of cross-section and smaller variation of wall thickness will be obtained. With the increase of the friction coefficient, the ovality of cross-section and the wall thickness thinning rate will decrease. With the increase of the pushing speed, the ovality and the wall thickness thinning rate decrease while the thickening rate increases. When push bending of the large radius tubes, a good lubricating condition can reduce the wall thickening problem at the intrados, which will ensure a better forming quality.

KEYWORDS: push-bending, finite element analysis, forming quality, lubrication