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Stretch Formability of High Strength Steel Sheets in Warm Forming

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Abstract

Warm forming at temperatures from 200°C to 600°C has several advantages compared with cold forming at room temperature: better shape accuracy, better stretch flange formability and lower press load. In this study, the stretch formability of uncoated high strength steel sheets and galvanized high strength steel sheets in warm forming was investigated by spherical stretch forming tests at temperatures from room temperature to 600°C. The experimental results showed that the maximum formable dome height without cracks in warm forming is lower than that in cold forming despite the lower material strength at elevated temperatures. In order to clarify the factors leading to poor stretch formability when using warm forming, the surface temperature and strain in the spherical stretch forming tests were examined. Sliding tests of strips of the uncoated steel sheets and galvanized steel sheets were also carried out under the same heating conditions as the spherical stretch forming tests. The results suggested that two factors could cause the degradation of stretch forming performance during warm forming: differences in material strength between high- and low-temperature areas, especially at high initial forming temperatures of more than 400°C, and high coefficients of friction, particularly at a low initial forming temperature of 200°C. It is necessary to take both factors into account during warm forming.

Keywords: sheet metal forming; stretch forming test; sliding test; material property; steel; warm forming; temperature measurement, FEM (finite element method).

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