

Prediction of Springback in U-bending of W-Temper AA6082 Aluminum Alloy

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Abstract : High-strength aluminum alloys have drawn a lot of attention because of the expanding demand for lightweight vehicle design in the automotive sector. Due to poor formability at room temperature, warm and hot forming have been advised. However, warm and hot forming methods need more steps in the production process and an advanced tooling system. In contrast, since ordinary tools can be used, forming sheets at room temperature in the W temper condition is advantageous. However, springback of supersaturated sheets and their thinning are critical challenges and must be resolved during the use of this technique. In this study, AA6082-T6 aluminum alloy was solution heat treated at different oven temperatures and times using a specially designed and developed furnace in order to optimize the W-temper heat treatment temperature. A U-shaped bending test was carried out at different time periods between W-temper heat treatment and forming operation. Finite element analysis (FEA) of U-bending was conducted using AutoForm aiming to validate the experimental result. The uniaxial tensile and unload test was performed in order to determine the kinematic hardening behavior of the material and has been optimized in the Finite element code using systematic process improvement (SPI). In the simulation, the effect of friction coefficient & blank holder force was considered. Springback parameters were evaluated by the geometry adopted from the NUMISHEET '93 benchmark problem. It is noted that the change of shape was higher at the more extended time periods between W-temper heat treatment and forming operation. Die radius was the most influential parameter at the flange springback. However, the change of shape shows an overall increasing tendency on the sidewall as the increase of radius of the punch than the radius of the die. The springback angles on the flange and sidewall seem to be highly influenced by the coefficient of friction than blank holding force, and the effect becomes increases as increasing the blank holding force.

Keywords : aluminum alloy, FEA, springback, SPI, U-bending, W-temper

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