

Abstract:

**A New Methodology for Formability Evaluation of Aluminum Alloy Sheets Over a Wide Range of Temperatures**

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There is increasing interest in fabricating structural automotive components from 7xxx-series aluminum (Al) alloy sheet to achieve higher in-service strength while reducing weight and cost compared to steel. One major technical issue preventing the widespread utilization of higher strength 7xxx-series Al-alloys is poor ductility at room temperature. Warm (less than 482°F) and hot (about 887°F) forming offers a potential means to overcome this limitation. In this work, a new methodology for formability evaluation of aluminum alloys sheet over a wide range of temperatures was successfully employed. The methodology used digital image correlation coupled with a high temperature hot gas bulge test system on a 150-ton hot forming press to experimentally obtain the material behavior of the Al alloy sheets to large strains. A novel die set with modularly exchangeable inserts are capable of determining an elevated temperature forming limit diagram, using out-of-plane stretching with the Nakajima test and the in-plane Marciniak stretching test, and allows one to obtain the material behavior in biaxial tension. Using this new methodology and die set, the formability and fracture behavior of AA7075 Al sheet materials in the F (as fabricated), and T6 (artificially aged) temper conditions was investigated.