FEA of High Strain Rate Superplastic Deep Drawing Process for Circular and Conical Cups of AA1080

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ABSTRACT

An analytical model to evaluate deep drawing process at elevated temperatures and under different blank holder pressure (BHP) and identified that temperature, punch speed, BHP, and friction are the main factors that influence formability. Industrial pure aluminum cannot be heat strengthened, through increased intensity of cold deformation, the only form of heat treatment is annealing. AA1080 is highly resistant to chemical attack and weathering. It is easily worked and welded. This is excellent for chemical processing equipment and other uses where product purity is important, and for metal pressings of all types where ductility is critical also, it is a soft workable alloys having high purity which gives excellent corrosion resistant.

The objective of the present work is to optimize the warm deep drawing process of AA1080 aluminum alloy using Taguchi technique for the cylindrical and conical cups. In this present work, a statistical approach based on Taguchi and ANOVA techniques was adopted to determine the merit of each of the process parameter on the formability of deep drawn cylindrical and conical cups. All the experimental results have been verified using D-FORM software.

The thickness of sheet, temperature, and coefficient of friction influence the effective stress. The major parameter which can influence volume of the cup is the thickness of sheet. The effective strain and the damage in the cups are affected by sheet thickness, temperature, coefficient of friction and strain rate. The damage in the cups was less in the thick sheets and it was more at high coefficient of friction, strain rate and temperature.

The successful conical cups of 1mm blank thickness were obtained with operating conditions of 500^{o}C, temperature; 0.1, coefficient of friction; and 500, strain rate. The successful conical cups of 1.5mm blank thickness were obtained with operating conditions of 300^{o}C, temperature; 0.05, coefficient of friction; and 500, strain rate.

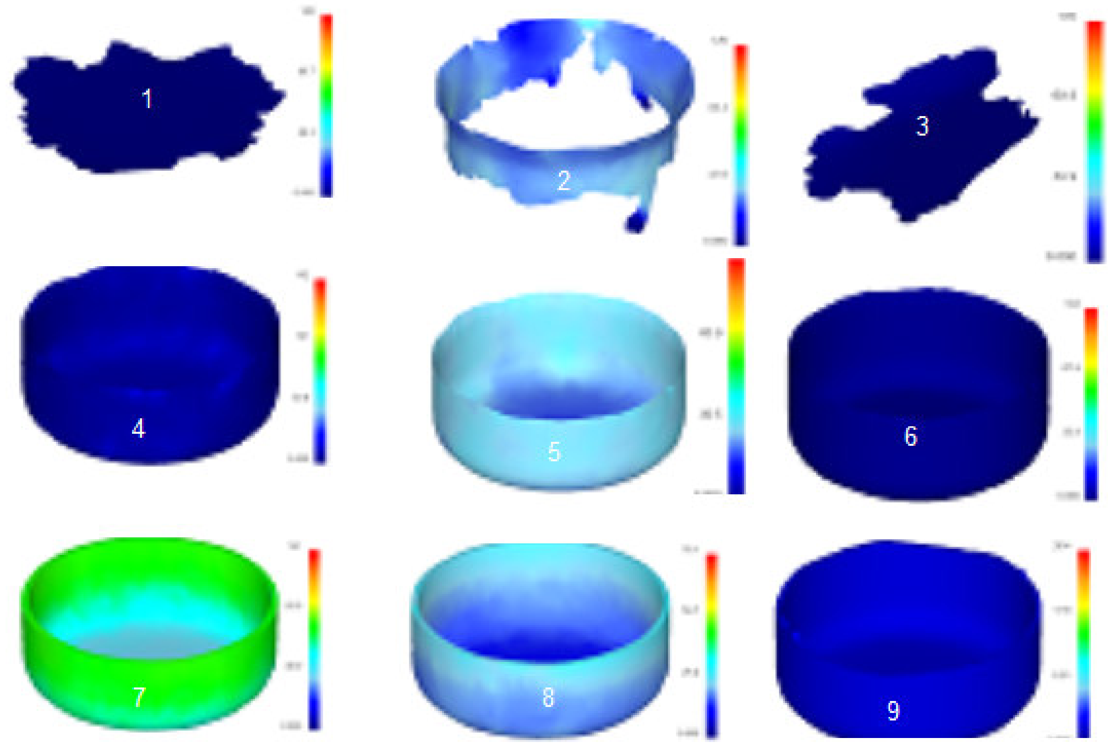

Figure 1: Effective stress in cylindrical cups under different operating conditions.

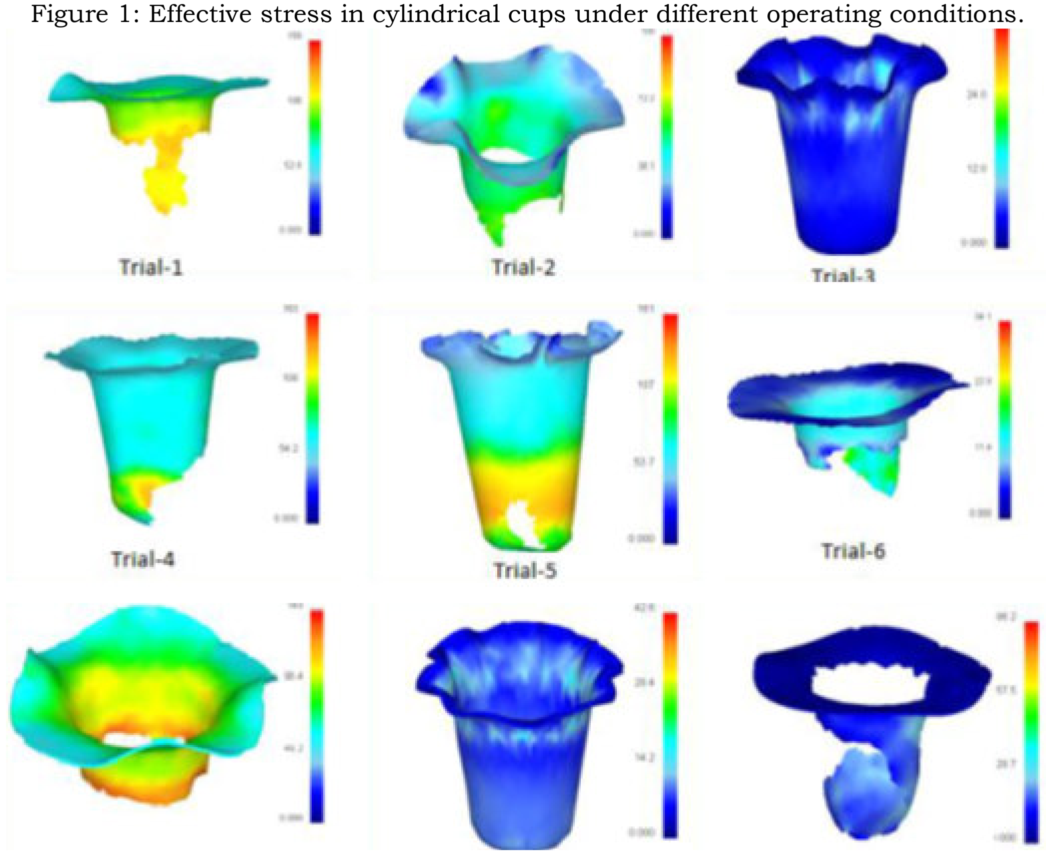

Figure 1: Effective stress in conical cups under different operating conditions.

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