

Optimization of process parameters of Deep Drawing Process for Inconel 600 Conical Cups

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ABSTRACT

The objective of the current work was to estimate plastic behavior of Inconel-600 alloy to manufacture conical cups under room temperature. The design procedure for the finite element analysis was carried out as per Taguchi techniques using DEFORM-3D software. The thickness of the blank, punch velocity, and coefficient of friction have been found influencing the quality of the cup. Forming operation is sheet metal forming operation, in which simple fixed sheet is deformed into a desirable shape by a punch which is hydraulically controlled. This process offers the possibility of production of complex parts in a single operation.

Experiments were designed using the Taguchi technique and ANOVA method was employed to estimate the influence of process parameters sheet thickness, punch velocity, coefficient of friction and Displacement per step on the stresses and strains developed in the sheet, damage of the sheet, height of the cup obtained and to find significant process parameters affecting the formability. A forming limit diagram (FLD) has been drawn out of the results to analyze the fracture phenomenon. The forming limit diagram were presented for the all the cups.

The present project work was carried out in two phases. Initial phase is numerical simulation of physical process with finite element analysis and final phase analysis of results for understanding its formability. The finite element analysis was carried out using DEFORM-3D software.

The Present investigation was focused on the process parameters such as punch velocity, coefficient of friction, Thickness and displacement per step. The major process parameters which could influence the deep drawing formability of Inconel 600 conical cups, were Thickness and step length. The successful conical cups were obtained with optimal process parameters were Sheet thickness of 1mm, Punch velocity of 3.5m/s, coefficient of friction of 0.1, Step length of 1.00mm.

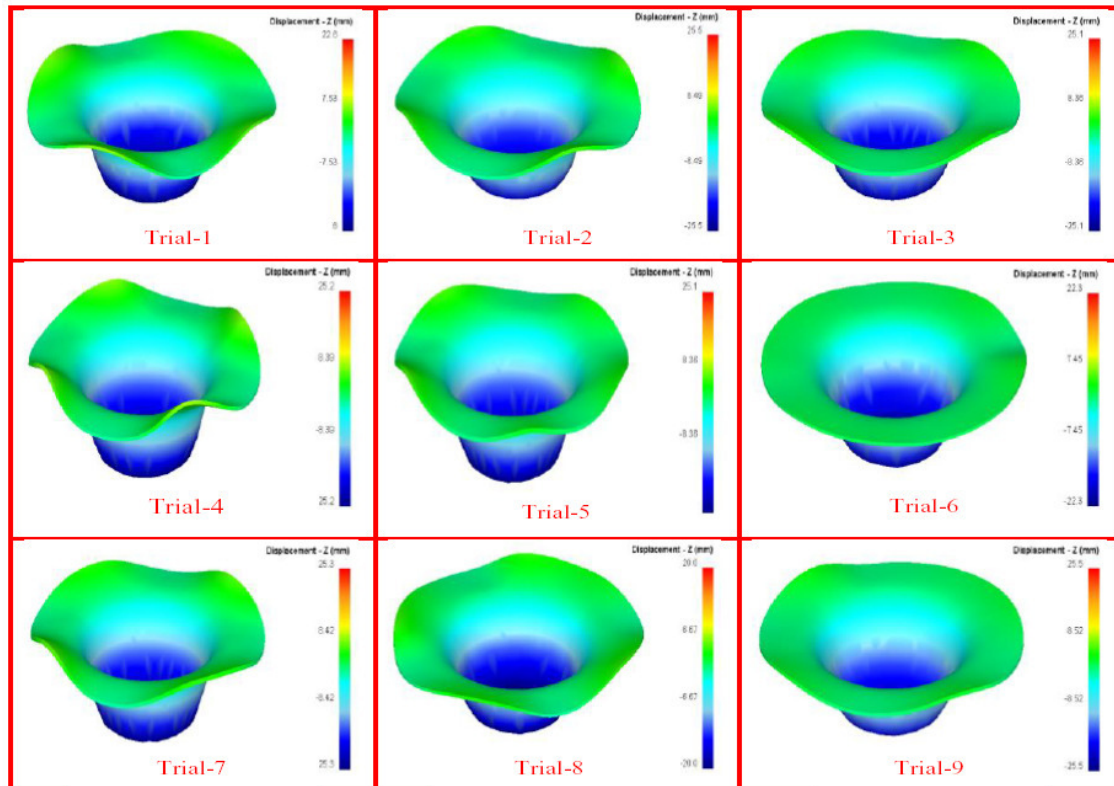


Figure 1: Height of the cup under different operating conditions

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