Optimization of Process Paraeters of SPCC Cylindrical Cups using Deep Drawing Process

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ABSTRACT

One of the main procedures for producing sheet metal parts is deep drawing. For the mass manufacturing of various forms like cylindrical cups, conical cups, etc., in the aerospace, autornotive, and packaging industries, parametric optimization of deep drawing is frequently required. To reduce the amount of expensive trial-and-error processes involved in tool design, finite element analysis can be used to simulate the process. This research is important for creating a component with a shorter manufacturing lead time. The significance of key process parameters, such as Thickness of sheet, punch velocity, coefficient of friction, And Strain Rate on the deep drawing characteristics were established in this project work.

The Optimization of process parameters is done by using Taguchi Technique using L9 Orthogonal Array Method. The degree of difference or similarity between two or more groups of data is determined using a statistical technique called Analysis of Variance (ANOVA). The D-FORM software uses the Finite Element Analysis (FEA) method. Using D-FORM software, analysis and simulations were conducted. The results obtained from D-FORM were validated experimentally. The optimal process parameters will be shown by the simulation results. For deep drawing SPCC JIS G3141 (A1S1-1008) is the material of choice.

The cup of Trail 7, with Sheet thickness 1.5mm, punch velocity 2.5 mm/s, coefficient of friction 0.15, and Strain Rate 5.0 1/s was found to be best drawn in terms of damage and effective stress.

CONCLUSIONS

In the present work, SPCC JIS G3141 (AISI-10081 was used for analysis. The investigation was focused on the process parameters such as sheet thickness punch velocity, coefficient of friction, strain rate. The major parameters which influenced damage of the cup were sheet thickness and coefficient of friction. The damage was found to be least when punch velocity, sheet thickness and coefficient of friction are 7.5mm /s. 1.5 mm and 0.1 respectively. Effective stress was found to be decreasing with increase in thickness and is most influenced by punch velocity. Effective stress was found to be decreasing from the coefficient of friction. The major parameter which influenced surface expansion ratio is the sheet thickness and found to be decreased with sheet thickness values from 0.5 mm to l.0 mm. Cup height was found to be decreasing with increase in coefficient of friction and the cup height decreased from increasing the sheet thickness 0.5 mm to 1.5 mm.

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