Finite element Analysis of Cold Deep Drawing Process for Conical Cups of AA1100

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ABSTRACT

Deep drawing is one of the most widely used processes in sheet metal forming. Apart from its use in many other sectors, it is applied in the automotive industry for the manufacturing of car body parts, packaging industry, aviation and model construction .The most common examples of deep drawing are probably the soft drinks cans we buy. So, understanding the mechanics of the cup drawing process helps in determining the general parameters that affect the deep drawing process. It is thus a shape transformation process with material retention.

In this present work, Taguchi techniques and finite element analysis were implemented to assess the formability of cylindrical cups using a cold deep drawing process. The process parameters are punch velocity, coefficient of friction, strain rate and displacement per step. The study was conducted by using DEFORM-3D. DEFORM-3D supports user routines and user defined variables. Complex multiple deforming body capability with arbitrary contact allows users to simulate mechanical joining and coupled die stress analysis. The purpose of presented work is to analyze the deep drawing process of thin walled, AA 1100, conical cup shape by means of a finite element simulation. In the presented study, simulation of the deep drawing process for determining distribution patterns of state variables in the drawn component for a particular displacement is carried out.

The process parameters were punch velocity, Thickness, Coefficient of friction, Displacement per step. The thickness of the blank, punch velocity, and coefficient of friction have been found influencing the quality of the cup. It is evident from the results that considered parameters can alter the physical characteristics of the cup obtained at the end of the drawing operation.

CONCLUSIONS

The major process parameters which influenced the quality of the cup were coefficient of friction and displacement per step. The effective stress was mainly influenced by the coefficient of friction. The cup damage increased with an increase in coefficient of friction. The best value of coefficient of friction is 0.1, as the displacement per step increased the height of the cup kept increasing.

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