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A REVIEW PAPER: EFFECTED PARAMETERS FORDEEP DRAWING PROCESS

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ABSTRACT: *For the reducing manufacturing cost for deep drawing process, optimization of process plays an important role. For carried out optimum value of process parameter, it is necessary to determine the behaviors of sheet metal during the deep drawing process. Mainly three parameters which affect the deep drawing process such as punch velocity, blank holding force and friction of coefficient. These papers study about different process parameters which effects on deep drawing process as well as to reduce process parameter by different optimization techniques. For achieve good quality of products in deep drawing process, it's possible with the help of these parameter's analysis.*

KEYWORDS*: - Deep Drawing Process, Process parameter Optimization*

INTRODUCTION

The sheet metal shaping procedure is utilized since a year back. Delivered sheet metal parts are utilized for some reason, for example, in car application, aviation field, kitchen product, and so forth the framing of sheet metal for required shapes is for the most part old strategy. The sheet metal procedure is a straightforward procedure in which metal framed into slender or level pieces up as far as possible. Shaping procedure of sheet metal relies on upon the material of sheet metal, thickness of sheet metal, twisting power, and so on amid the framing procedure on sheet metal, the forming operation relies on upon different parameters its known as framing points of confinement, such parameters are material properties, thickness of sheet metal, punch nose radii, clear (sheet metal) holding power, spring back power, and so forth deep drawing process is one of the best forming process to produce various size and shape of the conical or square shape of the component. Some parameters should affect during deep during processes such as wrinkling effect, fracture, shear failure, cup wall formation, drawing force concentration of formation at the corner of the cup. For achieving good quality of product need to optimize all effected parameters during deep drawing process. [5] Mohsen Hassan et al [2] have gave solution for this desire problem

1) Improve properties of drawing material
2) Use lubrication, tool geometry, optimum blank shape, temperature etc.
3) Improve initial condition.

However, to reduce in wrinkling effect during the deep drawing process M. Gavas et al [11] have studied -on this issue and finally reach on the conclusion that the instruments and tool parameters which affect for successful deep drawing process. Blank holding force improves to drawing a sheet metal quality.

Blank holder force allow for drawn material into the die without shearing. They searched that the blank holding force improves blank thickness distribution 1 to 1.01 times compare to without blank holder if blank holding force improves more than 1.7 time sheets or blank thickness goes to fracture best forming or deep drawing achieved at 1 to 1.3 times blank holding force same investigation done by Hail, Ibrahim Penira et al [13] they investigate on the aluminum alloy square cup for effect on the blank holder force. They have examined on deep drawing process for square cup with blank holding force or without blank holding force after that experimental work they conduced that best wall thickness best quality achieved by the use of blank holder and remove the wrinkling effect with help of blank holder. [10] A R Joshi, K D Kothari et al [7] gave review of the different parameter effect on the deep drawing process. Various defects occur in cylindrical cups such as flange wrinkling, wall thickness, tearing, earring, surface scratches eating effect generate due to properties of materials it blank properties is an anisotropic material should go in easing defect because of the properties of material stronger in only one direction wrinkling effect on wall generated because of the ridges in the flange are drawn into the wall of the cup. Tearing effect generated because of the force applied by punch is more than its requirement. Surface scratches produced because of friction generated between blank, die and punch. So, for the removing this effect lubricant is used, however, they also effect on drawing process such as die, radius, and clearance

MATERIAL SELECTION

Material selection important factor in deep drawing process, there are various material which properties are quite different from each other so, for achieving best optimal parameter there is need to select the proper material for the deep drawing process. Mohsen Hussein et al [2] have an experimental investigation of aluminum and brass material for conical shape. They selected 1.5 mm and 1 mm thickness for aluminum and brass 0% ironing. However, 10% of ironing for 0.9 mm thickness of brass and 20% ironing for 0.8 mm aluminum material. LDR value of brass and aluminum material, approximate 3.07 and 2.93 respectively the results indicate that properties of material are more effective parameter for good dimensional accuracy. Fuh-Kuo Chang et al [12] have studied on alloy AZ31 magnesium sheets for square cups they examine for effect of different temperature during deep drawing process. They produced square cup of magnesium material at room temperature and at 200 degree Celsius temperature. Both for different temperatures, they concluded that temperature to blank increase, which is directly affected for forming of blank in the die cavity. Hussein Selcuk et al [6] have worked on formability in hydro mechanical deep drawing process in this research they used AA5754 sheet with ductile property. Thickness of blank 1mm and material is composed at 3.1% Mg, 0.287% Fe, 0.16% Mn, 0.135% Si, 0.064% Cr, 0.006% Cu, < 0.02% Zn and 0.022% Ti. They experiment on flat plate by hydraulic system after experiment done they conclude that LDR value of flat blank holder was 2.61 and LDR value for 1mm blank holder was 2.762. However height of draw bead was increased 1 to 1.5 mm, LDR value was gone down. So, a material property is playing a vital role for deep drawing process.

EXPERIMENTAL SETUP

Yasunori Harada et al [3] have focused on to improve formability for Al alloy steel. They experiment on Ti- 15V -3 Cr- 5 Sn - 3 Al alloy sheet. Deep drawing process was done to analyze the limit drawing ratio (LDR) blank diameter was selected in range of 70 - 85 mm if blank diameter selected as 80mm then there was no crack found in defect or blank diameter more than 85 mm the sheet was not drawn. The limiting drawing ratio (LDR) for Ti-1S-3-3 alloy steel near about 2.0. After that they worked on oxide coating alloy sheet at 1023K for 70mm diameter blank sheet. Crack generated in 6^{th} cup in wall of the cup. Square cup deep drawing E. Bayraict et al [13] experiment were carried out with the help of Instron-1186 testing unit for using basic die punch setup. This testing machine use to measure strains on the surface cup after deformation circular grid shapes were measured with help of photography printing myler tape was used for measuring principal strain (&) examinations were performed by moving the cross head at a velocity of

1.68 mm/sec and cross head was halted at 15mm., 30mm, 40mm distance respectively. During the experimental work blank holding force applied to blank. Blank holding force during all experimental work remaining constant (19.6) KN At room temperature Young-Hwa-Lu et al [13] have studied optimum blank for square cup drawing process. They used hydraulic press with computerized control. Computer control helps the displaying relationship between punch load and punch stroke. As the variety of the stature was not critical in two cases, this implies embracing the typical an isotropic thought can secure a decent forecast of the ideal clear for the sheet utilized as a part of the analysis. Because of a sweep of 6mm over the punch head, the tallness of the continuum is roughly 3mm higher than the punch stroke utilized as a part of the expectation of the spaces. Moreover, the plan strains ideal spaces which have a sink esteem equipment to zero, where likewise inspected. An acknowledgement the thickness ought not to be changed in the angle for the plane strain condition implied that the sheet material in four corners ought to slide into the bite the dust despite that fact that the 1.0 mm spacer ring was still utilized as a part of the analysis.

COMPUTATIONAL TOOLS

Computational tools use for validation, experimental work with finite element analysis software package. FEA using to study for characteristics of the deep drawing process [1] Mohsen Hassan et al [2] have studied on deep drawing characteristics of a square cup through conical dies foe examine how to increase durability of square cups, an elastic- plastic FE simulation has been carried out for the pass on is completely compelled in all bearing while the punch is obliged in all aside from vertical course. Dis-loading and turn limit conditions were forced on the clear quarter contact between the clear and the apparatus surfaces include geometrical non- entrance and grinding conditions. The coefficients of contact at the bite the dust clear interface are accepted consistent and they procedure. The momentary contact condition is subject to particular crevice resilience on both sides of the sheet.

Fuh-con Chen et al [12] have researched on magnesium alloy AZ31 sheets. [9] They work on the investigation, the effects of process parameters such as punch radius, die radius, temperature in the deep drawing process. Experimental setup geometries were constructed in CAD program, PRO/Engineer after that all modeling parts converted into finite element mesh with the help of DELTA MESH. The impact of shaping temperature was concentrated first and ideal framing temperature got from the examination was then embraced in the resulting recreations for the examination of the impacts of punch span and bite the dust corner range on the square glass drawing. The drawing of a square of measurements 40x40 mm from a 0.5 mm thick AZ31 sheet was mimicked. The material properties and FLD of the AZ31 sheet acquired from the past tests were utilized as a part of the limited component reenactments. The other generation parameters were: went on slack of 0.6 mm on each side, clear holder force of 2.5 KN, coefficient of contact in 0.1, and punch bits of 3 mm/s. The constrained segment programming PAM STAMP was used to play out the examination and the four-center shell segment was used as a part of the reenactments.

OPTIMIZATION

Optimization is a process to find out maximum and minimum parameters (stress value) for deep drawing process or any other experimental process. It's used for comparing various experiments. For deep drawing process, optimization is used to analyze best probable stress value for optimum forming process.[4] Huseyin s selcukhalkaci and Mevlutturkoz and Murat dilmec [6] have optimized for hydro mechanical deep drawing. They worked on AA5754 sheet having a ductile characteristic. Researcher used tag chi's method for optimization, in taguchi's method several steps have to follow which are shown below,

Find out sound noise ratio, in which η is calculated by below equation,

$$\eta = -10 \log_{10}\left(\frac{1}{quality\ \ characteristics}\right)^2$$

After that calculate effect of parameter by below equation

$$m_{A1} = \frac{1}{3}\left(\eta_1 + \eta_2 + \eta_3\right)$$

Now find sum of squares of parameters is calculated by

$$= 3(m_{A1} - m)^2 + (m_{A2} - m)^2 + (m_{A3} - m)^2$$

Where, m is the overall mean of the n, after that calculated optimum parameter. Optimization technique is best way to optimize probably parameter. Dr. Kartik D Kothari and Dr. R L Jhala [7] used weighted principal component method for optimization of perforated sheet metal. Weighted principal component is more reliable and provide very accurate solution compared to Taguchi's method. Weighted principal component few steps are shown below,

$$\frac{S}{N} = -\eta log_{10}\left(\frac{1}{y_i^2}\right) or \frac{S}{N} = -\eta log_{10}(y_i^2)$$

S/N ratio Find as

$$X_i^* = \frac{X_i(j) - X_i(j)min}{X_i(j)max - X_i(j)min}$$

Marlab used to find COV matrix.

$$A = \text{cov}(X^*)$$

MPI find from below equation

$$MPI_j = \sum_{i=1}^{n} W_i \chi y_i$$

Max MPI value in dicate best min and max parameter for experimental value

CONCLUSION

Different segments are created by applying profound attracting prepare plain metal sheet. This shape/size segments are utilized as a part of vehicles field, aviation and in addition modern and home application moreover. In profound drawing process there are different parameters influenced, for example, punch power, clear holder, punch point and sheet material. From this writing survey, advancement of another procedure for delivering profound square glasses through cone shaped kicks the bucket, another procedure for creating profound square containers utilizing basic tooling set that requirements neither clear holder nor draw dots and is finished by a solitary acting stroke. Utilized a roundabout clear can be effectively twisted by a level headed square punch through a cone shaped kick the bucket with square opening and created the square container.

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