Study of Perforated Sheet (Light Weight Metal Sheet)
Patel Divyen1 Patel Pratik2 Patel Vikas3 Patel Yash4 Jasmin Hirapara5
1,2,3,4 Student 5 Assistant Professor
1,2,3,4,5 Department of Mechanical Engineering
1,2,3,4,5 PSE, Surat Patel Pratik, India

Abstract— We are also trying reduced the weight of perforated sheet by making groove, holes, chamfer & fillet on perforated sheet. We check other parameters of perforated sheet like velocity, stress on cut, groove work piece thickness, shape of perforation and pitch of perforation. For reducing the wrinkling effect on product, we try to modify the parameter like velocity of punch, diameter of die and punch, clearance between punch and die, BHF. The earring effect in formed part reduces by using 3D modeling and analysis. We go to reduce weight for increase power to weight in automobile industries. We compiles that objective by change in parameter of perforation operation like different shape of punch and die, change the velocity of punch, different BHF, etc. then we will collect data of different perforated sheet. The data show weight and strength of material. From data we can choose suitable material for automobile industries. Detailed investigations, including experimental tension tests, were performed also to analyze the local deformation of the subject sheet metal, and the validity of the proposed yield criterion. The current design and analyses can help the optimization of the control scheme of drawing processes rather than using the conventional designs. A comparison of the predicted and experimental results showed good agreement.

Key words: Deep Drawing Process, Perforation Sheet, Metal Sheet, BHF

I. INTRODUCTION

In this study, the deformation of a hole-type shadow mask has been analyses, the shadow mask being a thin perforated sheet in a monitor. Fig. 1 shows the hole type shadow mask and the cross-section of a hole, the size of which varies across the thickness. Two-dimensional (2D) and three-dimensional (3D) finite-element analyses have been used to analyses the deformation behavior of perforated sheets during uniaxial tension. Since the apparent mechanical properties of the perforated sheet depend on the hole size, the apparent mechanical properties of the shadow mask change across the thickness. Therefore, the shadow-mask specimen is subjected to bending when under uniaxial tension. The apparent mechanical properties and the radii of curvature of the tensile specimen have been calculated and compared with experimental results. [1]

However, if the components of the material are arranged in a periodic structure, the heterogeneous material can be replaced by a homogeneous material which has such properties that it behaves identical to the nonhomogeneous material on a global level. An illustrative example of such a material is represented by shadow mask which is an indispensable part of any color television tube. A shadow mask is essentially a perforated plate with a regular pattern of circular holes and can be considered to contain a metal component and an air component. To obtain the required manufacturing accuracy. [2]

We advanced a new yield criterion which can explain the deformation behavior of perforated sheets in the whole range of ligament efficiency, and analyses biaxial stretching of the perforated sheet for 36Ni-Fe Invar alloy shadow mask. The perforated sheet containing circular holes and applicable in dot-type shadow masks. The purpose of this study is to advance a new yield criterion which can explain the deformation behavior of perforated sheet containing slots, and to analysis biaxial stretching of slot-type shadow mask. [3]

II. PROBLEM DEFINITION

We visited Fabrication Company; they are faced earring defect, wrinkling effect, on two layer and multilayer composite sheets. Those problems are occur due to uneven or non-uniform material flow and blank holder force (BHF). Now a day, automobile industries have competition related to higher power to weight ratio. For sustain in competition we required reduce the weight or increase the power. For increasing the power we required higher CV’s (calorific value) fuel but that’s price is very high, so we try to other ways that’s reduced in weight for that we will reduced thickness give some holes and grooves and other discontinuity.

Some problems are include in forming process due to variant apply load velocity of punch, vibration of punch and die component and there for ununiformed strain induce in product.

Above discuss problem causes splitting, fractures, and tearing of final product or desired output.

III. OBJECTIVES

- Reducing the wrinkling effect on product, modify the parameter.
- Reduce weight for increase power to weight ratio in automobile industries.
- Product produces with desired thickness, shape, size, and uniform material flow by analysis on parameter of forming process.
IV. LITERATURE REVIEW

Seung Chul Baik[1], This paper represent the proper design and manufacture of tubes in heat exchangers and shadow masks in color monitors require the characterization of the deformation behavior of a perforated sheet containing a large number of holes. The analysis of the stress and strain in the perforated material is based on treating the perforated material as an equivalent solid material. Many attempts have been made to characterize the deformation behavior of perforated sheets, and the apparent elastic constants have been calculated. The yield criteria of perforated sheets with a uniform triangular pattern of round holes were proposed assuming that deformation of the ligaments occurs under the plane-stress or plane-strain conditions. The perforated sheet containing non-uniform holes was bent under uniaxial tension because the apparent plastic contraction ratio changes with hole size. The calculated radii of curvature of the bent sheets as a function of strain were in good agreement with the experimental results.

B. J. E. van Rens [2] this paper help out for an illustrative example of such a material is represented by shadow mask which is an indispensable part of any color television tube. A shadow mask is essentially a perforated plate with a regular pattern of circular holes and can be considered to contain a metal component and an air component. To obtain the required manufacturing accuracy, in depth knowledge of the elastoplastic behavior of the mask is necessary which can be obtained through the analysis. In order to avoid comprehensively large computational costs, the heterogeneous plate (with holes) is replaced by a homogeneous plate with appropriate material properties. In other words, the micro-mechanical effects induced by the perforation are simulated at macro-mechanical level by the development and incorporation of a dedicated elastoplastic material model. A method has been presented to determine the yield behavior of a plate with a regular pattern of holes. This method makes it possible to determine not only the initial yield surface but also the evolution. The material behavior of a perforated plate is modeled through homogenization. As a result of the homogenization, the computational costs are reduced considerably. Numerical experiments reveal that the shape of the yield surface and the chosen history parameters render results that agree with those achieved by modeling a perforated plate in detail.

Heung Nam Han [3], this paper represent Shadow masks for the color picture tube are made by stretch forming of perforated sheets. Therefore, manufacture of shadow masks requires characterization of deformation behavior of the perforated sheet. The procedure for analyzing the stress and strain of the perforated sheet is based on treating the perforated material as an equivalent solid material as in the analysis of deformation of porous materials. A new yield criterion, which can explain the yielding behavior of perforated sheet containing slots has been proposed. The yield curve obtained by the new yield criterion are in good agreement with those obtained by analysis. The uniaxial yield stress of the perforated sheet for slot-type shadow mask as a function of tension direction is very well predicted by the new yield criterion.

Fuh-Kuo Chen [4], the paper deals with the proper design and manufacture of tube sheets in heat-exchanger equipment and shadow-masks in high-resolution color picture tubes require the characterization of the plastic deformation of perforated sheet metals. There are two approaches for analyzing the plastic deformation of perforated sheet metals. The first treats the perforated sheet metal as an equivalent continuum which is both compressible and anisotropic. The other considers the perforated sheet metal as it is, namely, a two-phase material consisting of voids and metal. In general, a perforated sheet metal contains a large number of holes. Hence, although the two-phase material approach accurately describes local deformation, it is impractical, if not impossible, to perform the global analysis for the whole sheet by treating it as a two-phase material. The deformation behavior of perforated sheet metals depends on the geometry of the perforations and on their arrangements. The characterization of plastic deformation of perforated sheets was investigated for defining the yield criterion and establishing the flow rules in terms of apparent stresses and apparent strains, considering perforated sheet metals as compressible and porous materials. The deformation model for sheets with circular perforations in a hexagonal pattern was developed and the usefulness of the model was examined by the analysis of local deformation and by experiment. The model was formulated based on yielding in the minimum ligament region. The yield criterion for perforated sheet metal was defined from the conditions for two modes of yielding in biaxial stretching. It was shown that each of the two modes is operative, depending on the biaxial stress state. The apparent strains were derived from the yield criterion by applying the flow rules.

V. CONCLUSION

The flow curves and the contraction ratio of a shadow mask containing non-uniform holes have been analyzed under the assumption that the deformation behavior of the shadow mask is equal to that of a perforated sheet containing uniform holes. Yielding of the perforated sheet begins at the minimum ligament section, which is in a state of stress with a higher degree of triaxiality than any other region in the perforated sheet. The deformation behavior of the perforated sheet depends on the slip direction in the minimum ligament section at the yield point. The results obtained by 3D analysis are seen to be in good agreement with the experimental results. The flow curves and the apparent contraction ratios obtained by 2D analysis under plane stress are almost the same as the results of 3D analysis, because the shadow mask is a thin sheet. However, the yield stresses obtained by 3D analysis methods.

REFERENCES


[3] Seung Chul Baik!, Heung Nam Han!, Sang Heon Lee", Kyu Hwan Oh", Dong Nyung Lee", Plastic behavior of perforated sheets with slot-type holes under biaxial...
