Design and Analysis of 3d Printed Perforated Sheet Metal Testing and Manufacturing

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Abstract: *The Perforated sheet metal is a technical advanced technology in manufacturing field. This paper focus on study about forming process of perforated sheet metal as well as effect of various parameters on forming process of perforated sheet metal such as properties of material, thickness of material, stress analysis of the material, etc. To reduce manufacturing cost, it is an important task to study about optimization of process parameters and reduced it. From the study of these parameters, it's possible to get good quality of product.*

Keywords: *Perforated Sheet Metal; Stress Analysis; 3D Modeling, Deformation.*

I. INTRODUCTION

Perforated Sheets area unit created by punching regular flat sheets with a determined pattern for cosmetic or usability reasons. Perforated Sheets are often used in applications where the passing of water or air is crucial, like ventilation or filtering. Due to the punched pattern, these sheets are usually very light and thin. Perforated Sheet can be purchased at any Metal Supermarkets location and can be cut to your exact specifications.

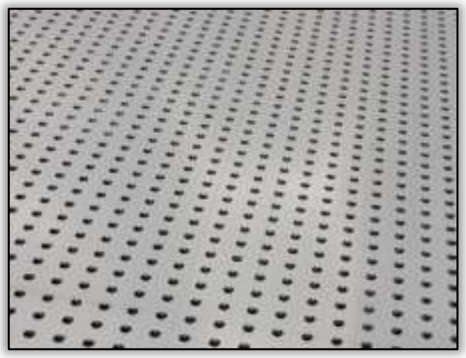


Fig 1 Perforated Sheet Metal

3D Printing is one in all the Additive layer fabrication processes. The 3D printing happening within the machine consists of 2 stages, the direct transfer from computer code knowledge to written structures, by repeatedly positioning the print head altogether 3 directions in area so as to print layer by layer the total object. Mentioned however the printing is dole out, initial the look is formed by a CAD system, and so the area unit as are written through a compilation of 2 dimensional slices representing the 3D object to consequently print layer by layer till the thing is completed. The second stage of the producing method may also be divided in 2 basic steps "coating and fusing", throughout these steps, the fabric is ordered over a surface and by the action of a supply of energy the layers area unit created. The supply of energy and therefore the raw materials vary reckoning on the used technology.

Perforated metal could be a style of flat solid that has been punched or sealed with a machine to make a pattern of holes. it's additionally referred to as perforated sheet, perforated plate, or perforated screen and is usually made of chrome steel, cold rolled steel, metal and a lot of. In this project we focus on properties of material, thickness of material, stress analysis of the material, etc. To reduce manufacturing cost, it is an important task to study about optimization of process parameters and reduced it. From the study of these parameters, it's possible to get good quality of product.

II. BACKGROUNDS AND RELATED WORK

Mass Customization of products: Mass production is one of the most used methods to manufacture in order to keep up with the growing demands in today industry. This made 3D printing one of the best forerunners in the mass production industry. On one hand, mass production means low costs. On the other hand, a better adaptation of the product's characteristics and its functions to the buyer's needs means the possibility of obtaining a higher price. That is why, for example, a luxurious product which is usually characterized by a high degree of adaptation to requirements and an adequate price cannot be a mass product. Mass customization is supposed to reconcile these extremes, namely make it possible to provide the customer product with high degree of adaptation and a price comparable to a mass product [5].

By using this conception, we are able to get Associate in understanding what 3D printing as a producing resource for mass customization are having on that of the concept of production by Henry Ford that if enforced justly creates a whole totally different market situation. within the future, we should always expect an extra development and diffusion of mass customization in future trade. this may be fostered not solely by factors that have thus far resulted in its creation and evolution. within the case of production, Associate in increasing role are compete by totally robotized systems with ever larger flexibility. The 3D printing technology looks to be terribly promising during this facet. On the opposite hand, relating to the identification of the customer's needs, IT systems gathering info from varied distributed sources so Associate in alyzing them and finding out patterns within the behaviour of specific customers can play an increasing role. The higher than demonstrates the necessity of custom-made production business that solely 3D printing will offer. ii. On Demand element Production: On Demand element Production is that the method of creating the element then and there looking on the client wants specifications and needs.

Sheet metal is having less weight and same strength compare to plain sheet. It is widely used in screens, filters, shields and guards. It is also used in architectural design. Wrinkling and stress intensity at the curved portion are the major problems which decreases the life of the product. This work is about to identify optimum forming parameters like punch velocity and co-efficient of friction to reduce wrinkling and stress Intensity. From all the above simulations, the minimum stress intensity is obtained in aluminum material of punch velocity 10 mm/sec and punch radius 5 mm and the value of stress intensity is 95.8 Mpa. The blank holding force has major influence on Deep drawing process. The die radius also has an influence in the process which is followed by punch nose radius [1].

Sheet metal (PSM) is a technical advancement in manufacturing field. This paper focus on study about forming process of perforated sheet metal as well as effect of various parameters on forming process of perforated sheet metal such as properties of material, thickness of material, punch velocity, spring back force, etc. For the detail study is carried out, material properties play an important role for forming process of perforated sheet metal. Due to material properties spring back effect also generated. Punch's nose radius is also playing a vital role for good quality product from the forming process. Blank holder Force expands grating and subsequently the required punch load. Subsequently, the clear holder power ought to be sufficient only to avert wrinkling of the spine. The edges of the punch and bite the dust are adjusted for the simple and smooth stream of metal. Leeway amongst pass on and punch is additionally given so sheet metal could be effectively suited. Inadequate or vast freedom may come about into shearing and tearing of the sheet [2].

Sheets are deformed to required shapes by plastic bending with the help of punch and die set in sheet metal working. However, after withdrawing the applied load, the contour assumes a different shape than that of die because of release of elastic stress in the metal. This elastic strain recovery is often known as spring back. Spring back result could be a major reason behind concern for metal forming industries that ends up in inaccuracies in final product created and eventually ends up in issues in assembly. This paper deals with spring back analysis of perforated steel sheet metal having circular holes arranged in square pattern using finite element analysis [3].

One of the needs of modern sheet metal forming is reliable knowledge about the formability of a given material. Forming limit diagram (FLD) is the most appropriate tool used to measure the formability. This FLD is influenced by the material / condition of the material, strain condition in geometrical features of a sheet metal. In this paper FLD of perforated Aluminium 1050A sheets are determined by drawing process. Limiting strain decreases when percentage of open area of sheet metal increases and hence the height of the curve gets decreased when percentage of open area increases. Hole size of the perforated sheet metals influences positively on limiting strain of perforated sheet metals and hence the increased hole size increases the height of forming limit curve. Forming limit curve is high when the holes are arranged in triangular pattern and it is less in the case of square pattern (i.e. holes arranged in square pattern) [4].

III. DESIGN

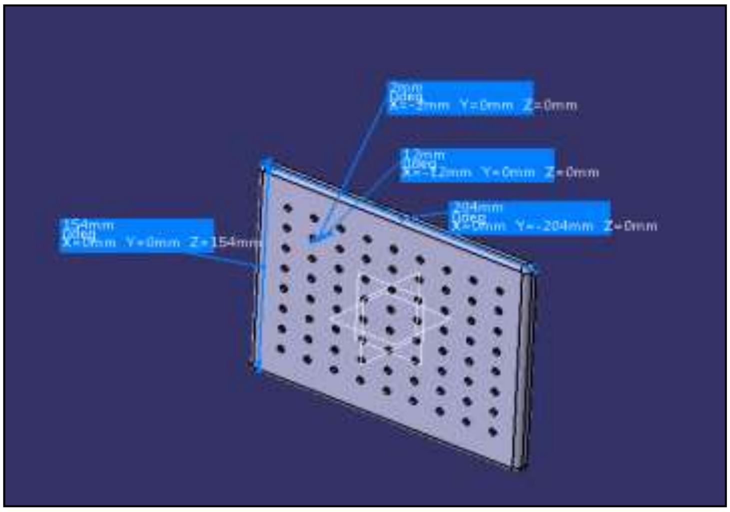
ABS Material Data Sheet

Physical Properties	**Metric**	**English**	**Comments**
Density	1.04	0.0376	Grade

	g/cc	lb/in^3	Count = 3
Melt Flow	18 - 23 g/10 min	18 - 23 g/10 min	Average = 21.3 g/10 min; Grade Count = 3
Mechanical Properties			
Hardness, Rockwell R	103 - 112	103 - 112	Average = 110; Grade Count = 3
Tensile Strength, Yield	42.5 - 44.8 MPa	6160 - 6500 psi	Average = 44 MPa; Grade Count = 3
Elongation at Break	23 - 25 %	23 - 25 %	Average = 24.3%; Grade Count = 3
Flexural Modulus	2.25 - 2.28 GPa	326 - 331 ksi	Average = 2.3GPa; Grade Count= 3
Flexural Yield Strength	60.6 - 73.1 MPa	8790 - 10600 psi	Average = 68.9 MPa; Grade Count = 3
Izod Impact, Notched	2.46 - 2.94 J/cm	4.61 - 5.51 ft-lb/in	Average = 2.8 J/cm; Grade Count= 3
Electrical Properties			
Arc Resistance	120 sec	120 sec	Grade Count=1
Comparative Tracking Index	600 V	600 V	Grade Count=1
Hot Wire Ignition, HWI	15 sec	15 sec	Grade Count=1
High Amp Arc Ignition, HAI	120 arcs	120 arcs	Grade Count=1
High Voltage Arc-Tracking Rate HVTR	25 mm/min	0.984 in/min	Grade Count = 1
Flammability, UL94	HB	HB	Grade Count = 3
Thermal Properties			
Maximum Service Temperature, Air	88 - 89 °C	190 - 192 °F	Average = 88.7°C; Grade Count = 3
Deflection Temperature at 1.8 MPa (264 psi)	88 - 89 °C	190 - 192 °F	Average = 88.7°C; Grade Count=3
Vicat Softening Point	100 °C	212 °F	Grade Count = 1

Fib.2. Design of the perforated sheet material, thickness of the material is 2mm and rest dimensions

IV. EXPERIMENTAL RESULTS



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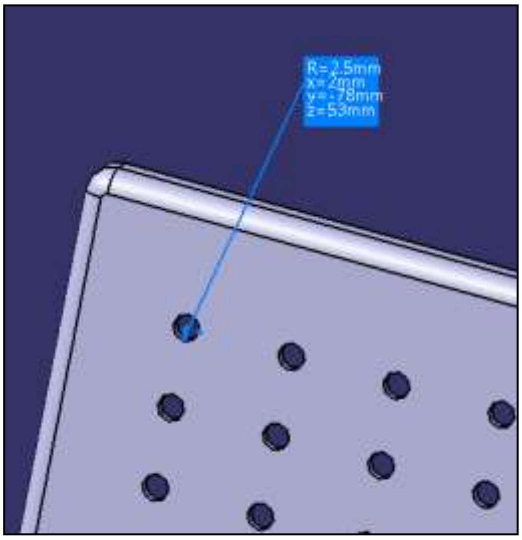

Fig.3. Hole dimension are shown in the figure.

V. CONCLUSION

The detail study is carried out; material properties play an important role for forming process of perforated sheet metal. Due to material properties spring back effect also generated. Punch's nose radius is also playing a vital role for good quality product from the forming process. The material properties are good as compare to the CI materials.

- Messing of perforated sheet metal.
- Then decide of material of perforated sheet metal.
- Analysis on Ansys.
- Then we will find the comparison between regular material and ABS (Acrylonitrile, Butadiene, and Styrene).

VI. ACKNOWLEDGMENT

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