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A University Emblem Die Design and Molding

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Abstract

To decrease the price of materials is very important. It is possible to make cost effective products by means of method that without machining i.ekitchen appliances, electronic devices and even plastic producsts. In this study one of the branch of design compression dies are investigated and a university emblem is studied using that kind of die. By compression dies any letters, numbers, figures and patterns can be produced on the metallic sheet. Frequently some problem such as cracking of punches and uniforming of the figures and patterns may be occurred. The advised solutions for those problems are enough compressing force and working materials hardness. Furthermore the hardness of the punch surfaceshould be among 58-64 Hrc.

Keywords: compression dies; emblem printing; design

1. Introduction

Manufacturing of products that are used in daily life in an economic way has importance in modern competitive age. Decorative products, kitchen utensils, electronic as well as polymer products etc. should be manufactured by such method that does not require machining, quick and convenient for mass production. Compressing molding is one of the well-known production method that satisfy these requirements.

In compression molding work pieces are soft and limited to certain thicknesses. The figures or patterns that are need to be printed on a work piece are processed on to mold punch. Punch surfaces are exposed to high wearing during operations, its surface is coated with chrome or nickel to reduce wearing rate. Pattern or figure on punch is transmitted to work piece by means fast strokes and with high compression force on punch. Bending or breaking of punches are frequently observed during manufacturing which leads undesired miss forming of materials. To overcome this problem suggested method is to apply correct compression force on punch and made punch from a material that 58-64 Hrc hardness level.

Coins, medallions etc. which are contains precious metals are also produced with compressing molding method. For instance, figures on front and back side of a coin is created by two punch stroke in once. Certainly manufacturing of these products needs careful selection of material and manufacturing process. In this paper, an emblem is going to be designed which is having print of “International University of Sarajevo (IUS)” on one side and flat on the other side.

2. Compression Molding

The process of molding a material in a confined shape by applying pressure and usually heat. Compression molding process is followed by two step first one preheating and pressurizing. Sheet-like materials are maintained betweenmale and female punch, subject to pressure to shape workpiece to desired figure or pattern [6].

In the pressing process of workpieces to find enough compressive force following formulation is used:

$$P = A * \sigma_b \quad \text{(kg)} \quad (1)$$

where,

$$A = surfacearea(mm2)$$

$$\sigma_b = compressionforceperunitsurfarcearea$$

To find value of σ_b one should look at in Table 1.

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Compression Molds

These kind of molds are working under high pressing forces due to that fracture of mold punch, or mold itself is likely. To overcome that, low pressing force and soft material for work piece should be considered. Another issue is adhesion; this can lead certain damage on mold [7]. Failure of mold due to high pressing load or because of workpiece usually reasons are listed below:

a) molding of very elaborate design.
b) large are of punching requires too much pressure
c) rich feature patterns or figure printing [8].

If pressed to the desired shape and trimmedworkpiece on a piece, but the opposite is not properly designed as smooth metal flow is disrupted. As a result of my dispersed mass to be designed right on the part working on it is required. Because otherwise it will reduce the life of the mold and achieve desired shapes or motifs in a not good way.

Table 1 Compressive Stress of some mostly used emblem material. [11]

Type of Material	Compressive Stress (kgf/mm^2)
Aluminum	64-112
Brass	84-180
Copper	40-112
Steel (Ç 1010)	80-264

3. Preparation of work piece

Printing should be defined for a contact between the mold surface of the material. These contacts are in the process of thermoforming or extrusion requires the re-distribution of wealth in the metal's crystalline structure.

After, emblem material composition defined, casting begins for that composition. Composition contains 69.5 % Cu, 12 % Ni, 18% Zn, and 0.5% Mn. Recommended hardness level for this composition should be around 50 Rc. Composition is obtained by melting raw materials around 870 C°. Composition is poured into mold that is in form of small ingots, here end product size and cutting clearances calculated to design size of these ingots. To ensure identical weight of work piece rolling process is used to form ingots into desired from of sheet metal. Thereafter, the sheet metal cuts in strips to get ready for punching into final shape before compression molding of work piece [1,2,9].

3.1. Coin and medallion molding preparation

Two-step meticulous work, including artistic and technical part. Firstly, emblem material and dimensions is decidedthen artistic part of it starts. It prepared utilizing the graphic pattern image classification miniature and calligraphy. After determining the pattern switches to model preparation with engraving and sculpture work.
Male acrylic pattern is prepared by using pantograph machine from previously created model. After that, punches are heat treated and hardening process done in oil with barium salt having temperature between 960-1020.

Punches are made of from 2550 oil steel and 2770 water hardened tool steel. After hardening (quenching) tempering process is done to reduce hardness and increase toughness of the material. Punch hardness are chosen between 55 to 59 Rc based on work piece (coin, emblem, medallion etc.) material. For instance, punch for brass (Cu 70 %+ Zn 30 %) and gold (Au) work piece should be 55 Rc and 59 Rc respectively.

3.2. Dimensional accuracy and work piece shape

To have good printing quality, design and mold accuracy should be considered carefully. Finishing is generally done on the latest stage. It gives accurate results as a result of a good machine labor.There are practical limits on workpiece shape. All this may be summarized as of press capacity and characteristics of the material to be molded [1]. For example, a material which has compressive load of 1,000,000 kgf/mm^2 with a 250 tones press, maximum a surface area of 50 m^2 can be pressed.

4. Printing Coin and medallions

Coins and medallions are produced in process which quantities more than 100,000 pieces. Banknotes are generally high-speed hydro - pneumatic and pneumatic press is manufactured using molds comprising an impact with less embossing on the back side.

Steel blanks and surface electro-coating process is performed to punch surface quality problems seen as a problem in recent years has declined. Covering the cost of cheap increased the applicant is through use of the common stereotypes in this method. Electro-plating industry is already developed. Very big efforts in recent years for the industry to print money is spent.

5. Formability of metals

5.1. Steels and Irons

The easiest pressed steels are defined as the alloys that contains 0.3 % carbon. Formability decreases when carbon content increases, more 0.30 % carbon content

in alloy usually makes it brittle and difficult to form under press. Nevertheless, material that contain sulfur are not recommended due to their brittle structure.

Metal coins and medallions are manufactured with compression molding method. In this method, work piece if feed in to mold cavity, and pressed with mold punch. Therefore, volume of work piece must be equal volume of mold cavity [1,2,3,4].

5.2. Production of silver alloy medallions

To manufacture medallion from 0.84 g silver alloy (95 % Ag, 5% Cu) necessary compression mold and its component shown in the Mold material

O1 toll steel

Mold hardness	*rock well C-60*
Compressive force	*150 ton*
Oilier no	
Formation time	*0.25 hour*
Production ratio	*48 piece/hour*
Total service life of the mold	*1000 to 10,000 piece*
Cost of tools	*$600*

Figure 1. Cutting and forming is done with a 140-ton press. There is no need for flanging in the process of medallions often. However, if design includes thick embossing, it would quire second press stroke to complete pressing. Before, the second pass previously pressed area tempered to increase toughness due to strain hardening of work piece [1,2,3,7].

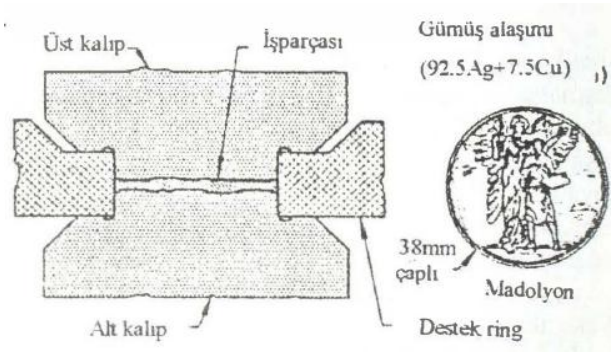

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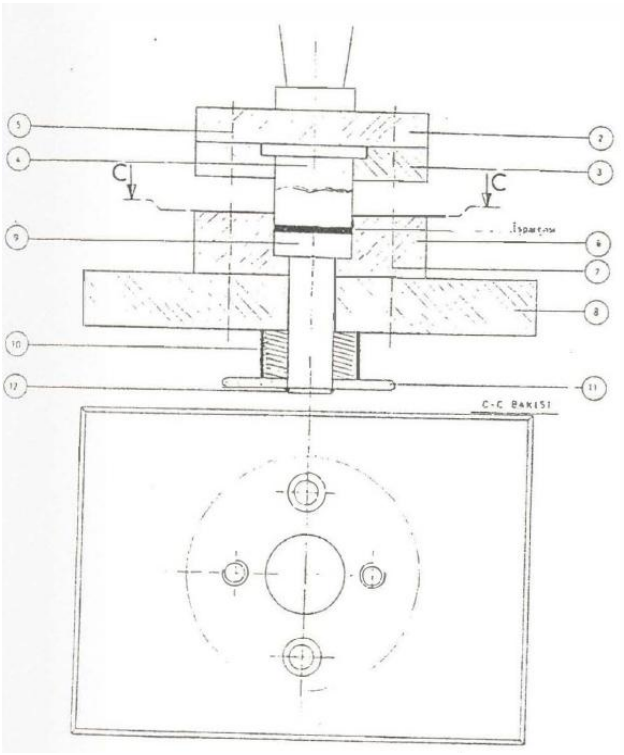
Figure 1Compressing mold used in Ag (Silver alloy) medallion pressing [1].

6. Analysis of problems and solutions

An appropriate mold cavity clearing is necessary to have good result from the molding. In the preparation of mold cavity, size of the work piece should be taken in to account. Details on a mold cavity should be formed in to work piece in once stroke of press or as much as minimum number of press stroke to reduce required time for molding.

Failure in the molding might be caused due to dirty mold cavity surfaces. While molding process airflow is used to prevent dust and other contaminant from mold



cavity to over this problem. A careful examination of molded products to detect possible problematic cases like oiling or sticking of material pieces to mold punch or cavity saves next coming work pieces being damaged.

Another source of failures is wrong sequence of materials based on their geometric tolerances and properties. Sequencing should be done considering following point; in a way that expected tolerance level from work piece to be produced.

Figure 2 Technical drawing of the mold assembly

7. Case study: IUS emblem design and molding

IUS (International University of Sarajevo) emblem mold design is studied in this section. Mold consists of

lower and upper group; in the upper group fastening stalk, holder plate and upper punch are placed. The university emblem (see *Figure 3*) should be pierced via pantograph bench on the upper punch which made of from SPK 2080 steel material advisably. The punch should be polished to remove possible burrs and hardened at least HRC 58. Lower group, might any faculty or program name would be pierce, in this study

it is considered as shiny flat surface without any printing.

Figure 3 IUS emblem (front face only)

Technical drawing of press and mold is given in *Figure 2*. After the mold montage, a 35-ton eccentric press would be enough to print the emblem. Emblem material for the print are selected as copper, aluminum and brass with 25 mm diameter and 2 mm thickness. From previous studies, it is reported that soft materials like copper and aluminum gives better results. This is due to high formability of soft materials.

8. Conclusions

Molding: a process which includes pressing circular /strip shaped workpiece once or in couple of sequence between two die which predesigned and manufactured to print certain figure on the material. Workpiece is trapped between die plates and by pressing appropriate pattern obtains.

Reasonably accurate process and oversensitive tolerances are required by the pressing. Cost is high for this process, however cost per piece relatively low since it is mass production capability. In order to reduce cost of the process die failures in terms of material selection needs to be considered. Recent findings showed that pressing coins, medals, emblems and similar products with electroplated die punches with bronze is improved service life and printing quality significantly. Currently, common coating material for the dies are pure nickel.

In this study, pressing the emblem of the university has not only cost problem but also design and material selection are another important problem to solve.

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