

Design and Manufacturing of Pet Bottle Die

Dr.Ch.S.Naga Prasad

Professor & Principal, Department of Mechanical Engineering, GIITS Engineering College, Aganampudi, Visakhapatnam(Dt.), Andhra Pradesh, India.

To Cite this Article

Dr.Ch.S.Naga Prasad, "Design and Manufacturing of Pet Bottle Die", *International Journal for Modern Trends in Science and Technology*, Vol. 03, Issue 04, 2017, pp. 31-33.

ABSTRACT

A bottle is a rigid container with a neck that is narrower than the body and a "mouth. Bottles are often made of glass, clay, plastic, aluminum or other impervious materials, and typically used to store liquids such as water, milk, soft drinks, ink, chemicals and etc. A device applied in the bottling line to seal the mouth of a bottle is termed an external bottle cap; the bottle has developed over millennia of use, with some of the earliest examples appearing in China, Phoenicia, Rome and Crete. Bottles are often recycled according to the SPI recycling code for the material. Some regions have a legally mandated deposit which is refunded after returning the bottle to the retailer.

Blow molding process is pretty much comparable with injection molding but the only difference is that, in this case, heated liquid plastic vertically pours out of barrel-like pot into molten tubes. The vacuum part is created. Most bottles are formed with this type of molding. Hot plastic resin is combined with a pressurized gas to fill and press the mold cavity, forming a hollow part. 3D modeling is done by pro-engineer.

Copyright © 2017 International Journal for Modern Trends in Science and Technology
All rights reserved.

I. INTRODUCTION

Die

A **die** is a specialized tool used in manufacturing industries to cut or shape material mostly using a press. Like molds, dies are generally customized to the item they are used to create. Products made with dies range from simple paper clips to complex pieces used in advanced technology.

Die forming



Progressive die with scrap strip and stampings

Forming dies are typically made by tool and die makers and put into production after mounting

into a press. The die is a metal block that is used for forming materials like sheet metal and plastic. For the vacuum forming of plastic sheet only a single form is used, typically to form transparent plastic containers (called blister packs) for merchandise. Vacuum forming is considered a simple molding thermoforming process but uses the same principles as die forming. For the forming of sheet metal, such as automobile body parts, two parts may be used: one, called the *punch*, performs the stretching, bending, and/or blanking operation, while another part, called the *die block*, securely clamps the workpiece and provides similar stretching, bending, and/or blanking operation. The workpiece may pass through several stages using different tools or operations to obtain the final form. In the case of an automotive component there will usually be a shearing operation after the main forming is done and then additional crimping or rolling operations to ensure

that all sharp edges are hidden and to add rigidity to the panel.

II. LITERATURE REVIEW

Blow Mould Tool Design and Manufacturing Process for 1litre Pet Bottle

The concepts of Blow molding is a process used to produce hollow objects from thermoplastic. The basic blow molding process has two fundamental phases. First, a parson (or a perform) of hot plastic resin in a somewhat tubular shape is created. Second, compressed air is used to expand the hot perform and press it against mould cavities. The pressure is held until the plastic cools. Blow molding process is used for which has thin wall sections. In this thesis, blow mould design is to be done for a bottle having 0.5mm thickness. This thickness cannot be filled in pressure injection molding. So blow molding is considered for pet bottle design. The mould is prepared by first modeling the part, extracting core & cavity and generating CNC program. Blow mould tool design is done in Pro/Engineer according to HASCO standards. A prototype of the pet bottle using blow mould design is also included.

III. PROBLEM DESCRIPTION

The objective of this project is to make a 3D model of the pet bottle die and manufacturing the same.

The methodology followed in the project is as follows:

- Create a 3D model of the pet bottle die using parametric software pro-engineer.

IV. INTRODUCTION TO CAD/CAE

Computer-aided design (CAD), also known as **computer-aided design and drafting (CADD)**, is the use of computer technology for the process of design and design-documentation.

4.1. Introduction to Pro-Engineer

Pro/ENGINEER Wildfire is the standard in 3D product design, featuring industry-leading productivity tools that promote best practices in design while ensuring compliance with your industry and company standards. Integrated Pro/ENGINEER CAD/CAM/CAE solutions allow you to design faster than ever, while maximizing innovation and quality to ultimately create exceptional products.

Different modules in pro/engineer

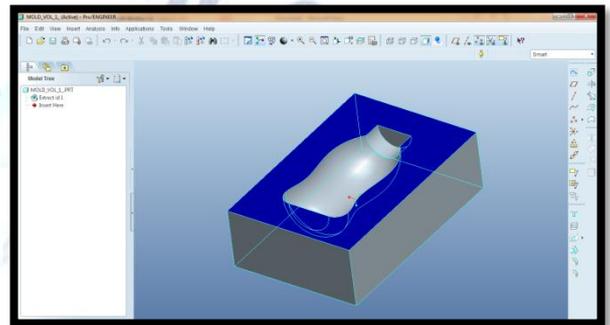
Part design, Assembly, Drawing& Sheet metal.

V. RESULTS AND DISCUSSIONS

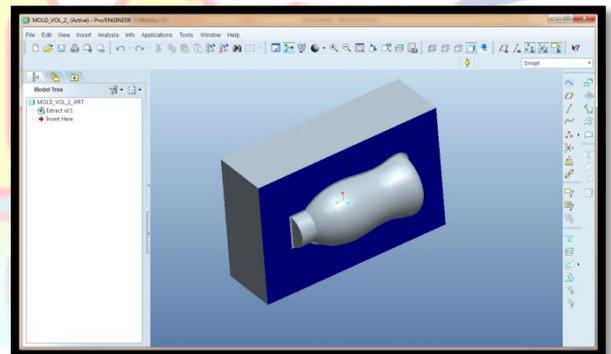
5.1 Models of pet bottle die using pro-e wildfire 5.0:

The pet bottle die is modeled using the given specifications and design formula from data book. The isometric view of pet bottle die is shown in below figure. The pet bottle outer casing body profile is sketched in sketcher and then it is revolved up to 360° angle using revolve option.

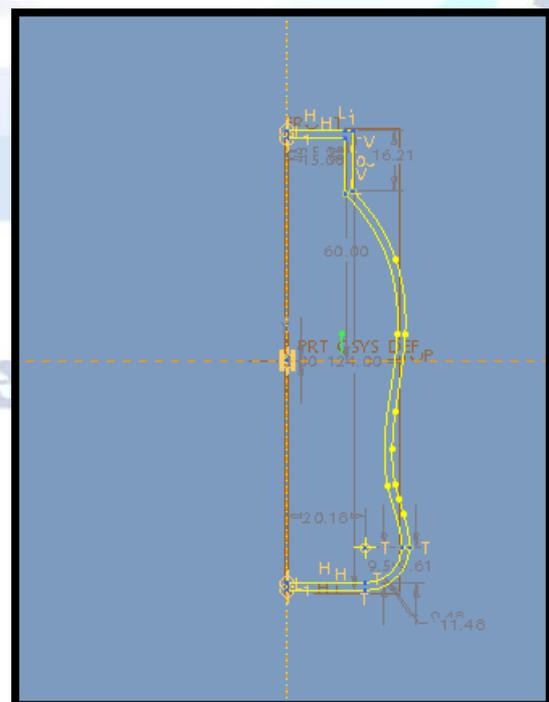
pet bottle die 3D model core



cavity



pet bottle 2D model



VI.MANUFACTURING PROCESS

By designed the mould tool for air PET BOTTLE, with the parameters now we can manufacture the air PET BOTTLE according to the dimensions. The flow chart of the manufacturing process of the air PET BOTTLE .

Raw material

hot die steels are most commonly used mould tool materials. they have Excellent toughness, ductility and harden ability .Used for vary large dies especially in thickness greater than 200mm .Also used for hot and warm forging and in extrusion tooling such as intricate dies and also dummy block ,liners, etc

Surface grinding

After selecting raw material surface grinding is done, Surface Grinding is a widely used process of machining in which a spinning wheel covered in rough particles cuts chips of metallic or non metallic substance making them flat or smooth.

CNC machining

In modern CNC systems, end-to-end component design is highly automated using CAD/CAM programs. The programs produce a computer file that is interpreted to extract the commands needed to operate a particular machine, and then loaded into the CNC machines for production. Since any particular component might require the use of a number of different tools - drills, saws, etc.

Heat treatment

To increase the strength of the material it is heat treated. Heat treatment is an important operation in the manufacturing process of machine parts and tools. Heat Treatment is the controlled heating and cooling of metals to alter their physical and mechanical properties without changing the product shape.



ROUGHING COMPONENT



Finishing component



VII.CONCLUSION

In this thesis a pet bottle is modelled in PRO-ENGINEER(CREO). The manufacturing process for pet bottle is stretch blow moulding. I have designed total die for the pet bottle under the guidance of expert. I have also prepared prototype for the bottle and the free form.

I conclude that this design of pet bottle withstands the pressures when soft drink is filled in the bottle. The pressure values are taken from standards of Coco – Cola Company.

I have completed blow moulding die according to standards. The design is ready for production.

REFERENCES

- [1] Belofsky, H., *Plastics: Product Design and Process Engineering*, Hanser Publishers, Munich, Vienna, New York, 1995.
- [2] Progelhof, R.C. and J.L. Throne, "Polymer Engineering Principles: Properties, Processes, and Tests for Design", Hanser Publishers, New York, 1993.