Bottle Blow Molding

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***Abstract -** The design of blow molds, Parison and the specification of process parameters are important and it is combined of science, art and skill. A small change in die and mold design, die temperature and blow pressure can greatly effect on the molding results, plastic forming behavior, materials parameters, the fluid viscosity and quality of the products .To validate these parameters and accelerate the design approval, prototype tooling is needed and it very costly and takes time.*

To reduce lead time and expenses, Finite Element Modeling (FEM) analysis is needed. It will predict and virtually assist the blow molding process design and very useful to support the foundry industry especially in designing a new product, redesign of existing products and detect the defects. By inputting blow pressure and temperature characteristic data, this analysis is able to simulate and visualize the blow molding process for achieving a uniform wall thickness in the final product .

***Key Words**: Blow Moulds, Prototype Tooling, Extrusion, Parson, Hydrostatic pressure, stacking.*

1. INTRODUCTION

Blow molding is a specific manufacturing process by which hollow plastic parts are formed and can be joined together. It is also used for manufacturing glass bottles or other shapes which are hollow in orientation. Blow molding is categorized in three types: extrusion blow molding, injection blow molding, and injection stretch blow molding. The blow molding process starts with melting down the plastic material and forming it into a shape called parison. In the case of injection and stretch blow molding a preform of the resultant product. The parison is a hollow piece of plastic with a provision of hole in one end through which compressed air can pass. The parison is then clamped into a mold with the help of clamping fixture and air is blown into it. The air pressure then pressurizes the molten plastic out to match the mold. Once the plastic has cooled and hardened the mold opens up and the final product part is ejected. The cost of blow molded parts is quiet higher than that of injection molded parts but low as compared to rotational molded parts.

1.1 Background

In the lower cost to process PE, the industry has evolved to further expand the gap. One of the greatest pushes in this area is called "light weighting," where unnecessary material is designed out of the package, saving weight. Light weighting not only reduces the material usage but also minimizes impact on the environment; this has been a driving force behind substantial research in this area. In case of design optimization, it is very critical to evaluate the structural performance of product bottles under different loading conditions.

1.2 Motivation

In blow molding simulations, numerical models have to take into account for the deformations of the material, the evolving contact between tool, polymer and temperature gradients. The aims by using this information, the manufacturer can improve the quality of its product, reduce lead time and reduce unnecessary costs, which eventually make them more competitive and gain more profit. The analysis will be focused to simulate the wall thickness distribution and stress counter.

2. PROCESS OF MANUFACTURING

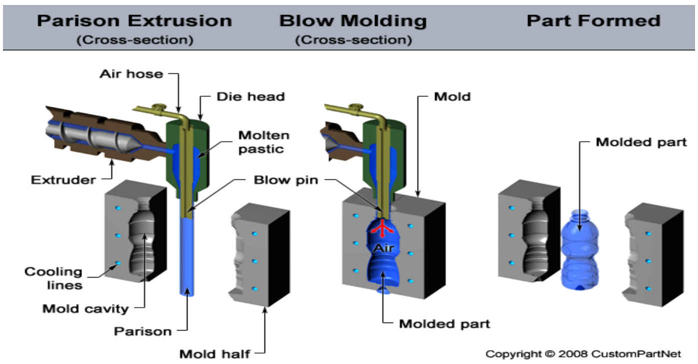
Molding process in which air is used as a pressurizing medium to inflate the molten soft plastic into a mold cavity. That is important for making one-piece rigid hollow plastic parts with thin walls, such as bottles. Since these items are used for beverages in mass quantities in markets. Production is generally organized for quantities. Because price of product depends upon the quantity.

Accomplished in two steps:

1. Fabrication of a starting tube.

2. Inflation of the preform tube to final shape.

Forming the parison is generally carried out by either Extrusion or Injection molding.



2.1 Extrusion Blow Molding:

(a) Extrusion of parison.

(b) Parison is pinched at the top and sealed at the bottom around a metal blow pin as the two halves of the mold come together.

(c) The tube is inflated so that it takes the shape of the mold cavity.

(d) Mold is opened to remove the solidified part.

2.2 Injection Blow Molding:

(a) Parison (preform) is injected molded around the blowing rod.

(b) Injection mold die is opened and parison is transferred to a blow mold.

(c) Soft polymer is inflated to conform to the blow mold.

(d) Blow mold is opened and blown product is removed.

2.3 Stretch Blow Molding:

Variation of injection blow molding in which the blowing rod extends downward into parison for stretching the soft plastic for a more favorable stressing of polymer than conventional blow molding. Resulting structure is rigid, with transparency and has impact resistance. Most widely used material is polyethylene terephthalate (PET) which has very low permeability and is strengthened by stretch blow molding. Combination of properties makes it as a perfect container for carbonated beverages.

2.4 Materials and Products used in Blow Molding:

Blow molding is limited to thermoplastics. Materials used are high density polyethylene, polypropylene (PP), polyvinylchloride (PVC), and polyethylene terephthalate. Products are disposable containers for liquid goods, large shipping drums (55 gallon) for liquids and powders, large storage tanks (2000 gallon), gasoline tanks, toys, and hulls for sail boards and small boats.

3. CONCLUSION

This analysis covers work carried out to substantiate deformation, principle stresses induced in Polypropylene (PE) Medicine Bottle of 100 ml which influenced by the Internal pressure, Hydrostatic pressure, stacking load and transport load. The work demonstrates that stresses in the specified areas are within allowable limits and that the (PE) Medicine Bottle of 100 ml is therefore satisfactory for the intended service as per client's technical specification.

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