

Design Optimization of Mold for Dust Proof Cap

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Abstract - Mould Design helps designers to improvement and quality of an injection molded part is dependent on many factors. These processes consider geometric parameters subjected to with the mold design and gate value system modification as well as process parameter such as molding condition during the filling phase. In the complete paper. The problem of optimization mold was addressed in this paper; the optimization problem can be broken into the subparts. The process is divided by using 3D printing product design for mold manufacturing effectively eliminates the use trial and error method by optimizing and validating the design of plastic products before production. This not only improves the quality but also helps to guide about the selection of machines and production planning An approximate feasible molding space (AFMS) is first determined to constrain the search space for the optimization. Quality is quantified as a function of simulation output and constitutes the objective function that must be minimized.

Key Words: Mould Design, Injection Molding, Optimization plastic injection mold, 3D printing, Approximate Feasible Molding space, Unigraphics(NX.06), mold wizard

1. INTRODUCTION

Protective dust caps and plugs play a crucial role in the life of quick coupling. Dust protection shields the connecting surfaces of couplers and nipples from environmental dust and dirt when the coupling is not connected. Dust caps are generally threaded and secured by screwing it onto the end of the stem. Dustproof cap generally for protecting over control panels, vacuum pipe, suction pipe, plastic wraps, packaging for computer hardware. Also, the dustproof cap plays the role for parts that require flexibility for which it serves very well. The material used for this molding process is waterproof, dustproof, corrosion proof for an inner and outer layer.

2. About action taken

2.1 About 3D modeling & Drafting of plastic product By using 3D CAD like Unigraphics NX 6.0 software we can design all types of concept parameter required for the mold design and product design. We can develop a type of 3D model and required view in understanding orientation. We can understand all type interference and motion of simulation [1]

2.2 3D Printing

3D Printing plays an important role is a development of prototypes in short time. With the help of the prototyped model, we can check the aesthetics, ergonomics and the assembly of the product as well. We can create plastic as well as metal prototypes. Also, we can look at a number of possibilities for designing a mold.

2.3 Mold Design using Mould Wizard for an optimum solution.

Using Mold Wizard module of Unigraphics NX 6 (Siemens product) the process of Mold Design can be done with ease as well as in the least time. This mold wizard generally helps for a user to create a first object mold drawing for next stage software mold base. You can select the shrinkage allowance for mold. Which type of ejector pin required, sprue bush, locating ring, sliders, runners, gating, and cooling line? By using mold wizard multiple molds is created automatically as per your requirement. [1]

3. LITERATURE REVIEW

Today's corrival world demands that in order to save self in demanding environment and market the entrepreneur and customer need ensure that their product gets designed and manufactured at cheap cost and less possible time. The most important thing to without losing their quality acceptance. So is must for a designer, workers in the production department, engineers work together in correlated fashion. Today CAD/CAM/CAE and 3D printing system are more accurate, cheap, less time required to get a result for your manufacturing product.

A CAD Software gives us a variety of Creation tools which allow us to proceed in a step by step way, so as to create a 3D representation of the product. CAD/3D printing software generally gives us a creation of a model by using 2D lines, arcs, curves, circle, solid models, wire frames using this we can move through solid face as per requirement and find final product. For this reference of molds cavity and core for these products can also be created using previously geometry created. [2]

3.1 Plastic Injection Molding

Molding is a manufacturing technique for making parts from a plastic material such as LDPE, HDPE, and Bayer 2407 or as per selection. The molten plastic is injected at high pressure into a mold, which is the inverse of the desired shape. The mold is made by a mold maker from metal; usually, the

material mold is oil hardened non-shrinking steel and high carbon high chromium die steel. Platen size in inches considers 2.95 X 2.95= 122.0 X 106.3 (Inch) and mold thickness is generally 1.18 inch.

3.2 Factor consideration

Have classified the factors that affect the quality of a molded part into four categories: part design, mold design, machine performance and processing conditions. They have all factor consideration about injection molding such as injection pressure, clamping capacity and shot capacity of injection mold also the required factor such as temperature, pressure and shrinkage allowance. During manufacturing of the product in injection molding quality characteristics may affect due to drifting and shifting of processing condition caused by machine wear, change in environment or operator failure problem.[3]

3.3 Injection molding

Injection molding is the most commonly used manufacturing process for the fabrication of plastic parts. The First assembly considers an injection unit, and mold assembly and clamping unit. Here raw material gets poured into the hopper and then go to the heated area where a heated section is present then at desired temperature plastic material are getting heated called as a molten plastic then goes through the molded part where mold cavity gets presented. Heated raw material get poured into the cavity and subjected part mold get their place and then cool molten plastic and get the desired shape as per requirement.[4]

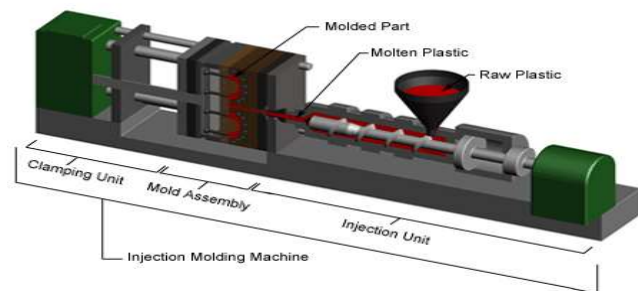


Fig 1. Injection Molding Machine

3.4 Failure and material selection of plastic mold

Material selection and heat treatment of plastic mold is an important selection of product and mold. Generally, the failure consider is dependent upon working condition, the material of mold and heat treatment consideration. Working treatment and condition are more difficult as per requirement. The Process is directly contacted with the plastic material which interconnected with temperature, pressure, and capacity. As per material selection flexibility and corrosion, friction is depending.

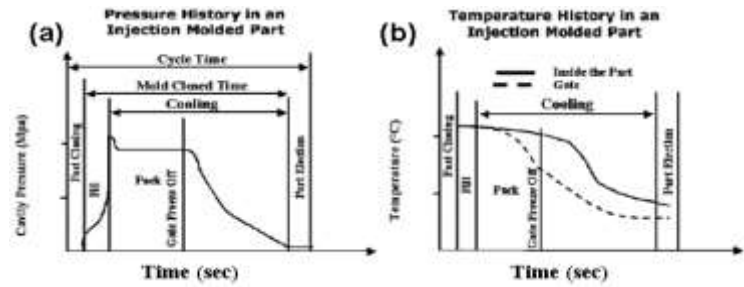


Fig. 2. Pressure And Temperature Cycle of Injection Molding

Methodology

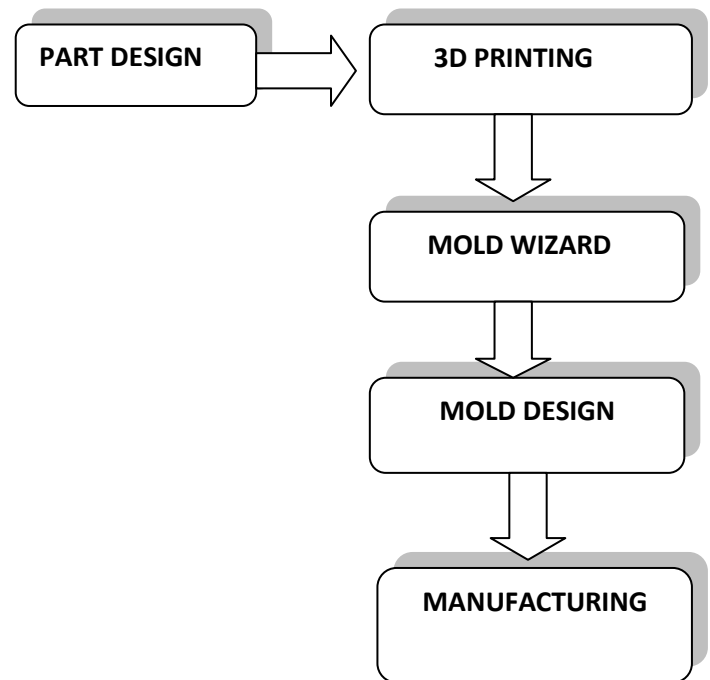


Fig 3. Methodology

4. Material Used For Molding

The Material used for creating the mold base is MS and for core/cavity is OHNS. There are many types of plastic materials that may be chosen in the plastic injection molding process. Most polymers may be select, considering all thermoplastics, some thermoset material, and some elastomers.

The Plastic that is softer and more flexible than other material. LDPE have lower tensile strength. It is not reactive at room temperature, except by strong oxidizing agent. LDPE withstand a temperature of 80 to 90 degree. The choice of a material for making injection molded product is not solely based upon the desired characteristics of the final part. LDPE have translucent and opaque variation. It is quite flexible and tough than other material.[5]

5. Problem incurred

Dust protective cap is generally creating a problem with a material. Generally, the problem arises with the identification of cap which fit on the desired panel, and then the material flexibility is not proper as per requirement, density not in range. We required material like which not reactive at room temperature. Except for a strong oxidizing agent. Made in translucent and opaque variations. It is quite flexible and tough. For the mold design, first design is only produces a four component which is not a perfect design for the productivity and cost factor and as per given time requirement. There is always change in mold structure base and create in changes assembly structure.

6. Optimization Of Mold

From the previous study, various types of caps are manufactured, but the general observation is mold industry create a separate mold base, mold channels, runners, gate, cooling channels, ejectors, controlling pillars and guides for every different dustproof cap. But the current situations we want only change a mold cavity base plate. Because of that, we save a lot of time required for full body design of all mold. Now we only make different mold cavity plate for required caps, which is cost is cost and time-saving, we also overcome a problem of space on mold we make more than 10 caps on over mold cavity than previous design only four caps is design and manufacturing.

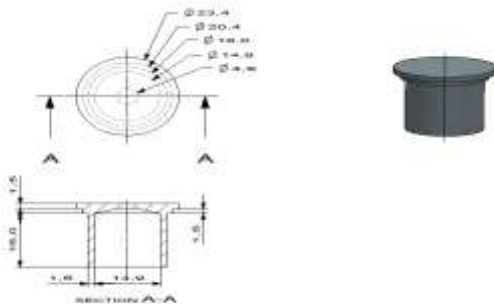


Fig.4. Drafting of Dust Cap Component

6.1 Optimization chart

Table no 1 optimization chart

Optimization chart			
Process: injection molding	mold no:1	Drawing no:10	m/c no:2
Part name: dust proof cap			
Material: LDPE	Shot weight:10.2gm	Regrind used: no	
Component wt.:1.1gm/pc	Color: natural	Reprocess: no	
Temperature			

Pre Heating Temperature (+/- 10° C) :- 120	Time : 2hrs	Heating time: 6min
Mold Heating Temperature (+/- 10° C) :-90	Time: continues	Cooling time: 4.6 min
Production on set:12	Injection time:2min	
		Time required one process: 14 min

7. CONCLUSIONS

Injection molding process generally describes the process of low cost and time consuming method of product developing method. From using 3D printing the process gets easier and precise method to get a final design for the mold, which minimize the problem occurred in dimensions and well structured design. Colour coding and numbering give the better identification to the product .

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REFERENCES

- [1] S. Patil, V. Shinde and B. Borkar, "design & analysis of plastic injection mould using nx-ug & delcam software", International Journal of Advance Reserch In Science And Engineering, vol. 5, no. 2, pp. 1-7, 2016.
- [2] W. C, S. Shamsuddin, I. Napsiah and H. A.M.S., "Design and simulation of plastic injection molding process", International Journal of Plastic Product, vol. 5, no. 2, pp. 85-99, 2004.
- [3] S. Kashyap and D. Datta, "Process parameter optimization of plastic injection molding: a review", International Journal of Plastics Technology, vol. 19, no. 1, pp. 1-18, 2015.
- [4] A. Darekar, V. T, B. Patil and Y. Doctor, "Review of Optimization Aspects for Plastic Injection Molding Process", Engineering Science and Technology: An International Journal, vol. 5, no. 1, 2015.
- [5] M. Salunke, R. Kate, V. Lomate and G. Sopal, "Review on Tool Design and Analysis of Injection Moulding", International Journal of Mechanical Engineering and Technology, vol. 6, no. 6, pp. 33-42, 2018.
- [6] Nagahanumaiah and B. Ravi, "Effects of injection molding parameters on shrinkage and weight of plastic part produced by DMLS mold", Rapid Prototyping Journal, vol. 15, no. 3, pp. 179-186, 2009.