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Design and analysis of a high pressure die casting die for "Lower Steering Helm"

B.Kapil[1], G.VenkataRamana[2]

[1] **Department of Mechanical Engineering, CMR Institute of Technology, Hyderabad, Andhra Pradesh-501401, India.**

[2] **Department of Mechanical Engineering, CMR Institute of Technology, Hyderabad, Andhra Pradesh-501401, India.**

Abstract

Die casting is a versatile process for producing engineered metal parts by forcing molten metal under high pressure into reusable steel molds. These molds, called dies, can be designed to produce complex shapes with a high degree of accuracy and repeatability. Parts can be sharply defined, with smooth or textured surfaces, and are suitable for a wide variety of attractive and serviceable finishes. The component produced in the die is lower cover which includes complex profile shapes such as gear profile, tap hole for further machining processes. Hence care should be taken while designing the die , In the present paper CAD plays an important role in making 3-D models of the Die elements using PRO/E and ANSYS which helps in reduction of redesign cycle time in future. Hence Computer Aided Engineering is an extension to capabilities.

Keywords: *Die casting high pressure ANSYS.*

1. Introduction

Casting is one of the oldest and traditional methods of manufacturing processes which includes trader us work. In casting we essentially start with an amorphous material, and hold it in shape while the material solidifies. The molds may be put through a baking stage to increase strength. Mold halves are mated and prepared for pouring metal. Metal is preheated in a furnace or crucible until is above the liquids temperature in a suitable range. The exact temperature may be closely controlled depending upon the application. Degassing, and other treatment processes may be done at this time, such as removal of impurities. The metal is poured slowly, but continuously into the mold until the mold is full. As the molten metal cools the metal will shrink. As the molten metal cools the volume will decrease. During this time molten metal may backflow from the molten risers to feed the part and maintain the same shapeThe Die casting is a modern process for the mass production of large quantities of metal components. The molten metal, for example aluminium alloy, is forced in to and maintained in a metal mold of die by hydrostatic pressure until it solidifies. The pressure employed may range from 50 kg/cm2 to 2100 kg/cm2 according to the mass of the die casting produced. Hence such die castings are termed as "high pressure die casting dies".

In pressure die cast the alloy, in a liquid or pasty condition, is injected under high pressure in to permanent mold, which is machined from steel die blocks and bears one or more impressions of the part to be produced. Recesses and holes are made by steel cores which are usually capable of being independently moved in or out of position and are inserted in to the die cavity prior to casting and withdrawn from the casting immediately it has solidify

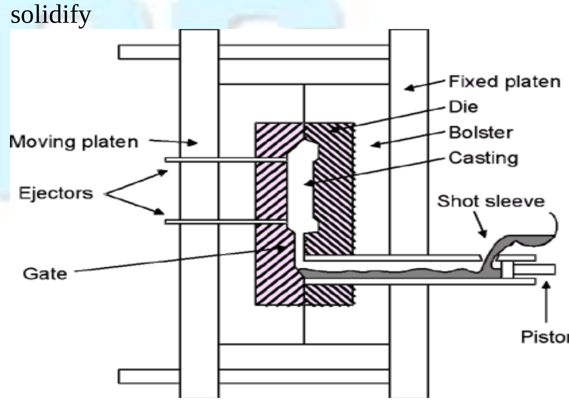

Fig1: Section view basic die casting die

The component produced in the die is lower cover which includes complex profile shapes such as gear profile, tap hole for further machining processes. Hence care should be taken while designing the die. The Die is designed by considering the following problems using PRO/E and ANSYS softwares 1. Filling problems 2. Shrinkage problems 3. Lack of Dimensional stability of the component. 4. High tooling cost.

2. Design of the Die

It has basically divided into two halves named as Cavity holder(bolster) and core holder(bolster) (or) Cavity die and Ejector die (or) Fixed half and moving half. The terminology is very commonly used for the same die parts. The die parts fall naturally into two sections or halves. The half attached to stationary platen of the machine is termed fixed half. The other half of the die attached to the moving platen of the machine is known simply as the moving half. The core is generally situated in the moving half. The casting as it is casted will shrink on the core and remain with it as the die opens. required calculations was done. Cavity holder is firmly fixed to machine platen. It has the provision to accommodate sprue bush and shot sleeve. Cavity insert is also fitted on cavity holder it has the profile of the cavity and gate is machined and located on this fixed insert, which forms the cavity portion. In present design the cavity insert is provided with dowel pin guides to minimize the run out of the die and also to reduce the misalignment of core and cavity axis , PRO/E software was used for designing the die

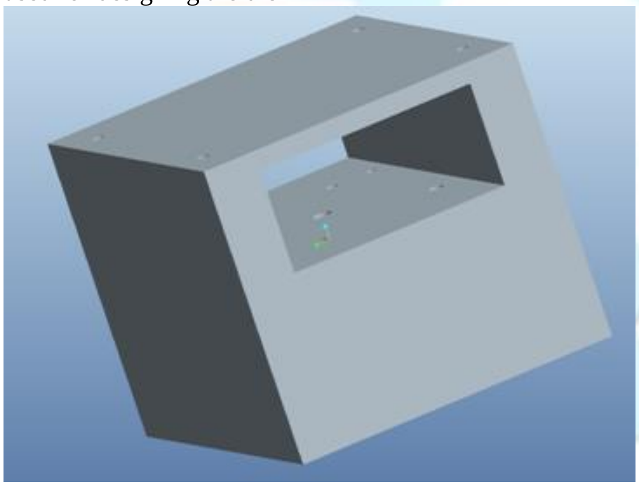

Fig2. Die Assembly

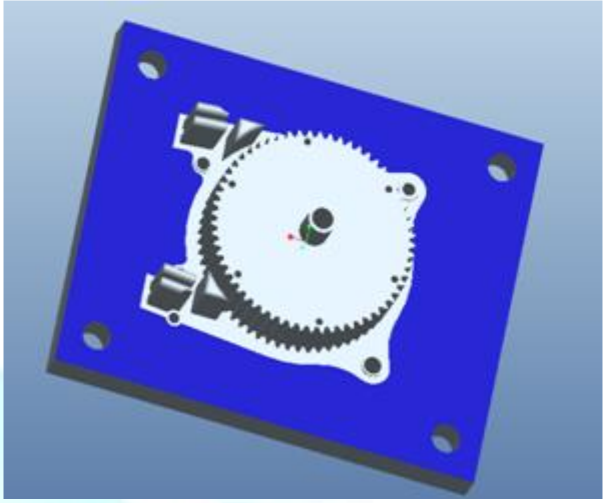

Fig.3 Moving Half Assembly

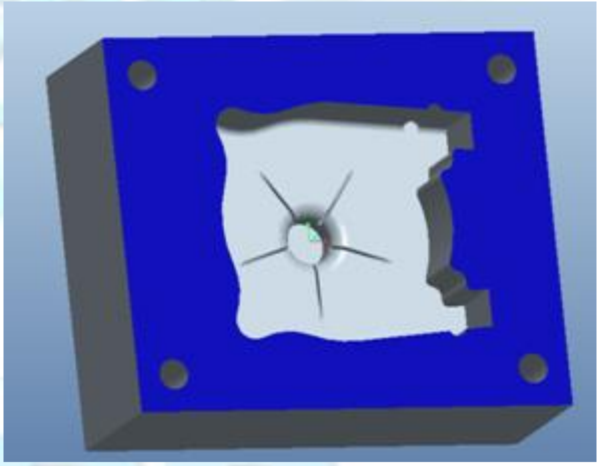

Fig.4.Fixed Half Assembly

3.Finite element analysis

Thermal analysis was conducted for core and cavity of the die by considering two different materials i.e EN36 HC HCr, The analysis results are shown in tables1and2.

Table.1 Results for Material EN 36

	Nodal temperature	Thermal gradient	Thermal flux
Core	560.041	2.731	0.300363
cavity	560.122	11.267	1.242

Table. 2 Material HC HCr

	Nodal temperature	Thermal gradient	Thermal flux
Core	560.003	22.786	0.524069
Cavity	560	253.483	5.83

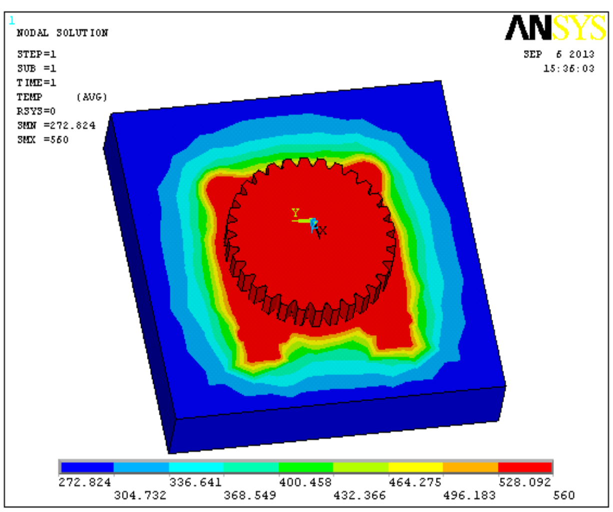

Fig 5 Nodal solution for core

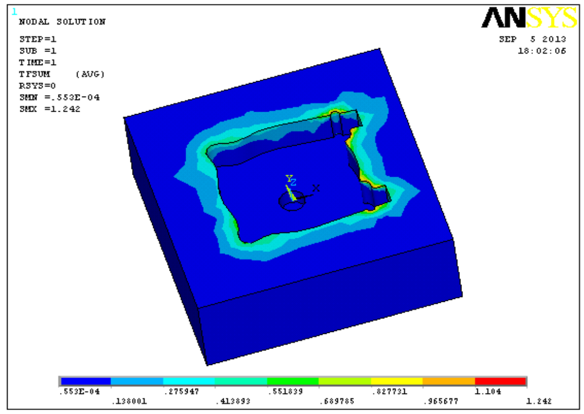

Fig.6 Nodal solutions for cavity

5.Conclusions

On the basis of above results we have conclude between to materials EN 36 AND HCHCr , HCHCr is having more thermal gradient and thermal flux then EN 36. In future better we will take HCHCr as a design material to sustain more temperature, having more strength and good finish

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