

# Design and Analysis of Injection Molding Die for Churner

Mr. Prashant A.Dhaware<sup>1</sup>, Prof. A.M.Kalje<sup>2</sup>, Prof. M. A. Sayeed.<sup>3</sup>

<sup>1</sup>M.E. Design, Mechanical Engineering Department, N.B.N. Sinhgad College of Engineering, Solapur.(Maharashtra)

<sup>2</sup> Associate Professor ,Head Mechanical Engineering Department,. N.B.N. Sinhgad College of Engineering, Solapur.(Maharashtra)

<sup>3</sup>Assistant Professor, Mechanical Engineering Department, N.B.N. Sinhgad College of Engineering, Solapur.(Maharashtra)

## ABSTRACT

*The appliance industry is changing leaps and bounds now days. The customers not only look at the workability of the product but also to the appearance of the product, its material and durability. The present study tries to design and analyze a die for the churner to be made up of plastic and for this analytical calculation and software analysis has been carried out and is presented in this paper.*

**Keywords:-** churner, die design, analysis

## 1.INTRODUCTION

The appliance industry is well aware of changing family needs and wants that families are time and energy starved, and they desire safety and comfort in their homes and with the appliances they choose to use. "People today expect the tedious aspects of housework to be dealt with by appliances, but they also expect appliances to help with the more creative and interesting activities, such as preparation of food," says Mr. Hawley of Creda. This trend is likely to become more marked and will be noted increasingly in the at-present underdeveloped areas of the world affecting export markets. "The kitchen appliances market is pegged at Rs 700 crore in India and is growing at 30 to 40 per cent," says Sanjeev Dayal, CMO, Kaff Appliances. With increased urbanisation and increase in disposable income, there is a vast opportunity for new and improved appliance to tap the growing market. One can be rest assured of the fact that the market potential is encouraging and times ahead will prove the obvious sooner than later.[2] Wood is a popular traditional choice for some utensils, such as spoons, spatulas an churner. One of the distinct advantages of wood is that it will not scratch even the most delicate cooking surfaces. Another advantage of wood as a material for utensils is that it does not conduct heat. Thus churner is not an exception it is an general observation that a typical Indian house has a wooden churner stainless steel which is normally used for the preparation of the butter milk and other liquid food items The disadvantage of wood utensils is that they are harder to clean than stainless steel or plastic cooking utensils. Also, wood can tend to present a favorable environment for bacteria growth, as Stainless steel cooking utensils are by far the least likely to allow bacteria to thrive, and are by far the easiest cooking utensils to clean. They are attractive to look at, and are available with a wide variety of handle styles and tool heads. The downside of stainless steel appliance/utensils, however, is that they can scratch nonstick or cast iron pots. Even if you are very careful, you risk damaging the all-important cooking surface, as stainless steel is typically harder than cast iron or the materials used for nonstick cookware. Plastic utensils are made expressly to avoid scratching the surfaces of nonstick or cast iron pots, and tends to be easy to clean. That's the good news. Plastic, however, has its disadvantages. Plastic cooking utensils are not as resistant to heat as wood or metal, and may actually D-shaped if left in a hot pot unattended. You can also visit us at [www.300-chicken-recipe.com](http://www.300-chicken-recipe.com). That could at best be difficult to clean, and at worst, ruin the pan. Additionally, if a plastic utensil melts, it can contaminate the food it melts. Plastic utensils tend to be very affordable while, stainless steel appliance is the most expensive one.



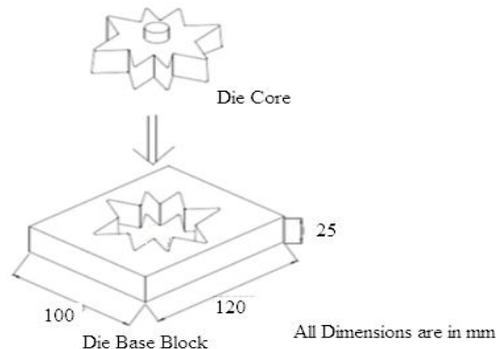
**FIGURE 1** Image of a Churner

## 2. RESEARCH METHODOLOGY

After the identification of the problem and carrying out the extensive literature survey related to the existing technology for injection molding the research methodology is being discussed here. It includes the detail explanation of the design and modeling of the die, analysis of the die being designed and the comparison of the analytical and ANSYS results.

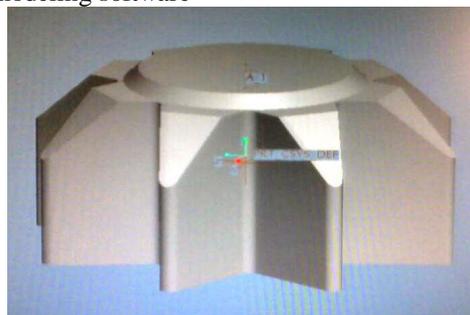
### ✓ Design and Modeling

The first and the foremost step in the design is the idea generation. This is the step where we find different solutions to the problem of the work being carried out. From the literature review and the existing churner device the following concept based as shown in Figure 1 on the use of churner design is thought as the solution to the problem of the current work.



**Figure 1** Schematic diagram of a churner die and base block concept

The selected design concept was modeled using the modeling software like CATIA V5 R19. The Figure 2 gives the image of a churner developed in the modeling software

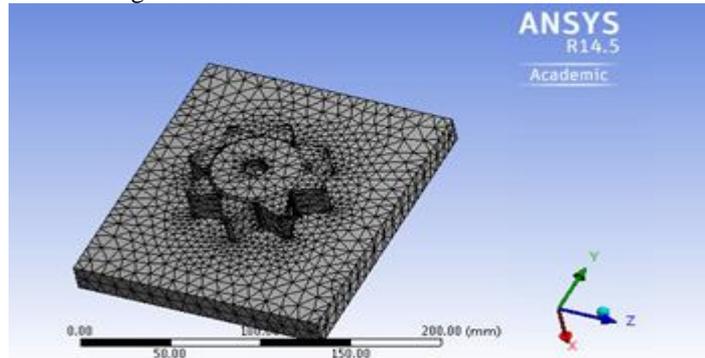


**FIGURE 2** CATIA Model of a Churner

### ✓ Analysis

The dimensions of the device being considered in the design are used. Having accurate dimensions of solid model is generated using CATIA V5 R19 and is imported to the ANSYS. The tetrahedral element is used for meshing the current model of the die as the mesh can be used to mesh very complex geometrical shapes also the element is less

sensitive to distortion The designed model is attached with a base plate for the ease of clamping. The same model is meshed for the analysis as shown in Figure 3 below.

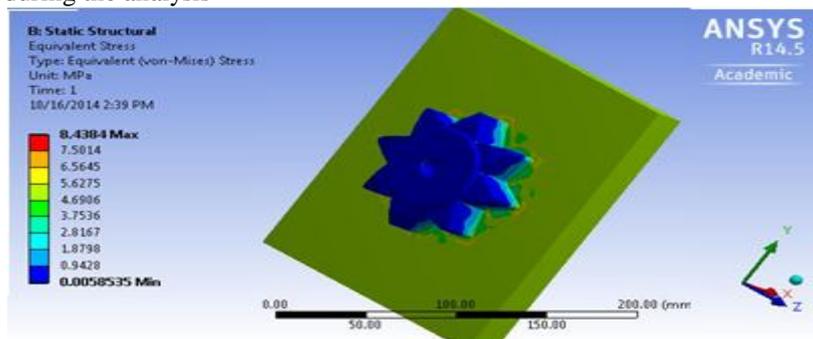


**Figure 3** Meshed model of the churner die

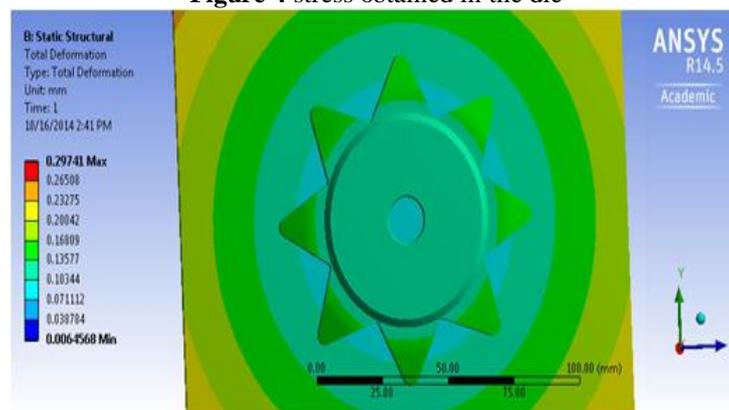
This part discusses geometry generation used for finite element analysis, describes the accuracy of the model and explains the simplifications that were made to obtain an efficient FE model. Mesh generation is discussed. Using proper boundary conditions and type of loading are important since they strongly affect the results of the finite element analysis. Above mentioned FE model is used for static and thermal analysis of the die considering the boundary conditions.

### 3.RESULTS AND DISCUSSIONS

After the successful design and analysis of the parts it is required to match the analytical and FEM results in respect of stress. The following chapter deals with the ANSYS results along with the comparison between the results thus validating them. The stress obtained from the ANSYS is shown in the Figure 4. The Figure 5 shows the total deformation obtained during the analysis



**Figure 4** stress obtained in the die



**Figure 5** Deformation obtained in the die

The results obtained during the analytical calculations and ANSYS can be compared as shown in the table 1  
Table 1 Comparison of the results

	<b>Analytical</b>	<b>ANSYS</b>	<b>Variation (%)</b>
Stress	5.55	5.627	1.3
Total Deformation	0.325	0.29741	8.6

#### 4.CONCLUSIONS

Design and Analysis of the Die is carried out during the project work.

Following conclusions can be drawn from this project work.

- The designed Die is suitable for the production of number of units in kitchen appliances.
- The die being designed can be helpful in reducing Cost of the product.
- Analytically calculated stress and the thermal stress in the parts of die is within limit. This ensures safe design of die based on analytical formulations.
- Successfully used commercial FEA tool ANSYS in the design validation of die.
- Percentage error in analytical and ANSYS results is within 15%.
- Thus at the end we can say that the objectives of this work are being achieved as far as possible by being within the scope of the work.

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