Optimization Design of Injection Mold for Rolling Comb Based on Mold Flow

Baofu Sun, Cong Jiang and Haixiong Wang

ABSTRACT

Taking the rolling comb as the research object, the process of the injection molding was simulated by Moldflow software. We have optimized both the location of injection gate and the parameters of injection molding process and analyzed possible defects. The experimental verification shows that in the design phase, Moldflow can find the product defects which may occur in the future. And this can help to improve the success rate for the first time. Therefore production costs are reduced and production efficiency can be improved.¹

INTRODUCTION

Recently, CAD / CAE / CAM technology gradually applied to the mold industry[1]. Injection molding is currently the most widely used plastic molding technology[2]. Moldflow software is the most representative software in the application of injection mold CAE analysis. It can not only simulate the flow of thermoplastic melt into the mold, but also the plastic gate position, pressure distribution, cooling process and injection process conditions, it improves the success rate for the first time[3].

Preprocessing

CAD doctor is the connection bridge of CAD platform, and it can not only seamless connectivity between all the software on the platform, but also improve the

¹Bao-fu Sun, Cong Jiang, Hai-xiong Wang. College of Mechanical and Control Engineering, Guilin University of Technology, Guilin, China.
quality, performance, and added value of the products[4]. Using the CAD doctor in Mold flow to set some processing of the comb, as shown in Figure 1.

![Figure 1. Comb model.](image)

![Figure 2. Filling results.](image)

**CAE Analysis**

**FILLING ANALYSIS**

The system is set as double-cavity mold, we can see from Figure 2, there are air traps and weld lines in the model after injection molding, The main reason is that the absorbency of ABS material is strong. When the material is plasticized, it contains more moisture, which causes the air traps and weld lines. The maximum Filling temperature is 232.2 °C, the minimum is 227.7 °C, the filling time is 1.137 s, therefore, injection will not produce insufficient injection and hysteresis phenomenon.

**COOLING AND WARPAGE ANALYSIS**

The experiment divides the grid into double-layer grids, and uses the analysis sequence of "cooling + filling + packing + warping" to analyze the initial warpage of
the model. It can be seen from Figure 3, mold temperature range between 37.55 ℃ ~ 55.87 ℃, the temperature difference is smaller, circuit coolant temperature is 26.47 ℃, the temperature and set the water temperature difference 1.47 ℃, the temperature difference is less than 2 ℃.

![Figure 3. Cooling results.](image)

![Figure 4. Deflection](image)

The deformation of plastic parts is generally caused by factors such as cooling, shrinkage and molecular orientation[5]. It can be seen from Figure 4 that the maximum warpage is 0.5331 mm, the deformation caused by cooling is only 0.0229 mm, the maximum warpage caused by shrinkage is 0.5241 mm, the maximum warpage caused by molecular orientation is 0.0496 mm. Therefore, shrinkage is the main cause of warpage.

**CONCLUSIONS**

We apply Moldflow software to simulate the injection mold process of the rolling comb, and optimize gate position and injection molding process parameters. We can improve the defect by optimizing the process parameters. Moldflow analysis
can improve the quality of plastic parts and reduce the times of trial and shorten the production cycle, so as to reduce production cost and improve production efficiency.

REFERENCES