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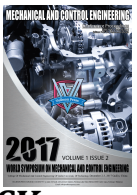

ANALYSIS OF TWO KINDS OF INJECTION MOLDS FOR MOBILE PHONE BACK COVER BASED ON MOLDFLOW

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ABSTRACT

Firstly, application of Moldflow on the mobile phone cover with two different injection methods which one is to use pin-point gate and the other is to use latent gate to simulate the injection molding process, then we analyze the results from the filling time, air traps, weld lines and the warpage four aspects. Lastly, we find out the effect of latent gate is better than that of pin-point gate by compare the above four results.

1. Introduction

The back cover of the mobile phone is plastic part, and the design and production of plastic molds require a lot of financial and material resources. With the increasingly fierce market competition, the traditional production experience of mobile phone back cover has become increasingly unable to meet the needs [1]. However, the researchers can use of Moldflow in the design period of back cover to avoid the blindness in design, and they can complete the mold testing work before the mold processing, meanwhile the workers can predict the influence of process parameters on product appearance and performance, and save a lot of material and financial resources [2].

2. GENERAL PREPROCESSING

We use of SolidWorks to build the model of mobile phone back cover, which the size is 131mm×66mm×6mm, the product demands smooth surface, and no cracks. The model shown in Figure 1. The part's material is Generic ABS, it has good chemical stability and mechanical strength [3]. We import the model into Moldflow, global edge length is set as 5mm, the part is divided by Dual Domain Mesh, and the mesh is not automatically generated, the Mesh Statistics are received as follow. The Max Aspect Ratio is 6.2, Average Aspect Ratio is 1.62, the number free edges is 0, Match percentage is 95.3%, the quality of the grid has been met the qualification.

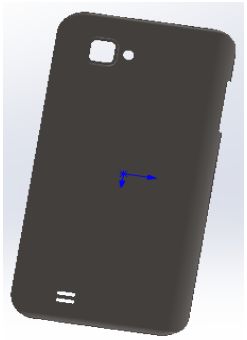

Figure 1: Back Cover

3. PIN-POINT GATE METHOD

3.1 Runner System and Cooling Circuit

First, the system is set as double-cavity mold, two gates inject in each mold cavity [4]. The sprue is located at the two gates Center to facilitate the removal of the condensate from the spure, the shape is tapered which is controlled by angle, its start diameter is 3mm and tapered angle is 1.5deg, the cross-section of top gate is also circular, and the shape is tapered which is controlled by end dimensions, the start diameter is 2.5mm, the end diameter is 1mm [5].

The quality of the cooling systems is directly related to the quality of the plastic parts [6]. There are two ways to create circuit in Moldflow, one is to set up a cooling circuit according to the guide, and the other is to manually build circuit, we use the former to set up cooling circuit [7]. The channel diameter is 8mm, the circuit alignment is set as X mode, based on the size of the plastic parts, the number of channels is 4, the distance between channel centers is 55mm, and the distance to extend beyond part is 30 mm, the model is shown as figure 2.

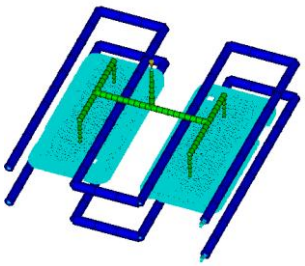

Figure 2: Runner System Cooling Circuit

3.2 Injection Molding Analysis

The Melt temperature is set 230°, Mold-open time is 5s, Injection+packing+cooling time is 30s, Velocity/pressure switch-over and Pack/holding control set to be automatic control. Setting "Cool+Fill+Pack+Warp" analysis sequence, then start the analysis. After the analysis is completed, we chose to analyze the three analysis results of fill time, weld lines and warpage.

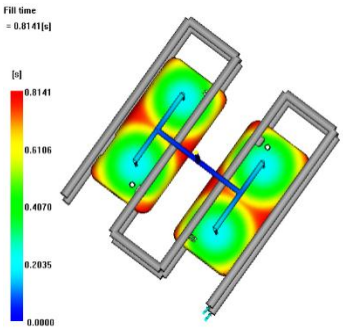

Figure 3: Fill time

We can see from Figure 3, the maximum fill time is 0.8141s, the model of the mobile phone back cover is filled, the filling assembles from the two gates gradually to the center.

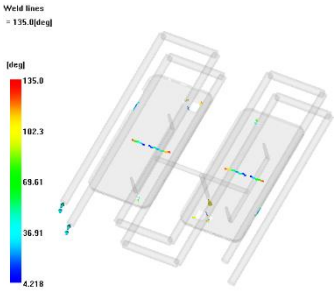

Figure 4: Weld Lines

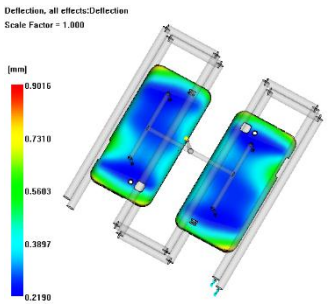

Figure 5: Warpage

In Figure 4, the minimum is 4.210deg, and the weld lines are mostly in the center of the back cover. As shown in Figure 5, The back-cover plane has less warpage, and the minimum warpage is 0.2190mm，and the maximum warpage is at the corner of the back cover, it's 0.9016mm.

4. Latent Type Gate Method

4.1 Running System and Cooling Circuit

We use the latent type gate which its position is set on the inner side of the back cover, the start diameter of the sprue is 3mm and tapered angle is 2 deg, the gate type is set as circular gate, the start diameter is 1mm, and tapered angle is 9 deg. The cooling circuit of this method is the same as that of pin-point gate. The model is shown as figure 6.

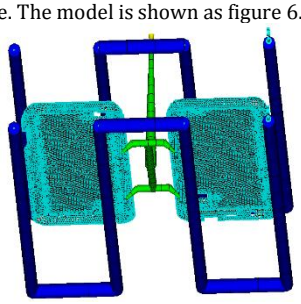

Figure 6: Running System and Cooling Circuit

4.2 Injection Molding Analysis

The process setting of this method is the same as that of pin-point gate. After the analysis is completed, we chose to analyze the three analysis results of fill time, weld lines and warpage.

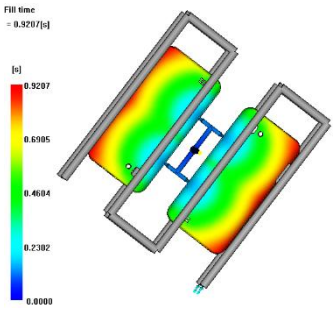

Figure 7: Fill time

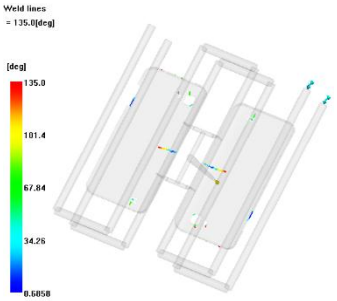

Figure 8: Weld Lines

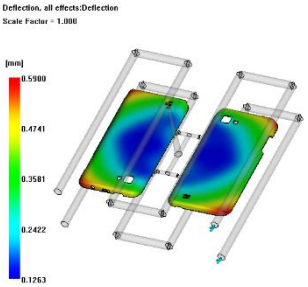

Figure 9: Warpage

In Figure 7, the maximum filling time is 0.9207s, and the filling starts from the side where the gates are set to the other side. In Figure 8, weld lines mainly occur near the center of the two gates, there also are some other parts where weld lines exist. In Figure 9, warpage extend along the side where the gates are located to the other side, the minimum is 0.1263mm, and the maximum warpage position is at the corner of the back-cover model, it is 0.5900mm.

5. CONCLUSION

Based on the analysis of the results of the above two methods. For the filling time, we can see that the second method has less time than the first, and the filling effect of latent type gate is better than that of pin-point gate. For the weld lines, when we use pin-point gate, the weld lines are focus on the center of the back cover, however, the weld lines are comparatively scattered when we use latent type gate, and there also are some weld lines in the back-cover center. For the warpage, when we use pin-point gate to feed the model, the cover plane has less warpage, however, both the maximum value and the minimum value of the warpage which is generated by the feeding of the pin-point gate are larger than those of the latent gate. Generally, compared to the pin-point gate, the advantage of the latent gate is that the filling is fast and uniform, meanwhile the warpage is smaller.

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