Plastic mold design of top-cover of out-shell of mouse based on CAE

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Abstract

The article analysis the product construction and manufacturing technology, aso points out the parting surface design, the cavity mold design and the punch mold design, calculating deformation parts working size, drawing of assembly and parts' graphs, manufacturing process of plastic mold.

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The product is the top-cover of out-shell of mouse. Firstly, it should have some comprehensive mechanical properties, including good mechanical strength, stable electrical property, and chemical performance. From the material's origin and cost, ABS is the suitable one. From the economic, using and forming property, ABS material can satisfy the all demands [1, 2].

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1 Analysis of product technology and construction

The mouse model is as Fig1, it concludes upper cover (Fig2-1, Fig2-2), bottom shell, left keyboard, right keyboard, rolling wheel, etc. The design is the part as Fig2.

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![Fig1 Mouse model](image1)
![Fig2-1 Upper cover](image2)
![Fig2-2 Upper cover](image3)

2 style of mold construction

2.1 Design of parting surface

According to the principle of parting surface choice, from the comprehensive analysis, the two plans are selected: one parting surface style; two parting surfaces style. While the two parting surfaces style has such characteristics: the material inputting smoothly and evenly, but the mold construction is complex, the mold thickness is increased, it spends more. The one parting surface can make the mold construction simple, decrease the mold plate thickness, and let the raw material little, the distance of inputting material strip also has been shortened[3].

From the contrast of two plans, the style of one parting surface have more advantages than the style of two parting surface, and it also can reduce the mold’s cost, so the mold adopts the style of one parting surface.

The top surface of top cover of mouse is selected as parting surface, it is also designed by Pro/E.

2.2 The construction design of deforming components

2.2.1 The construction design of cavity mold

The cavity mold is the component which deforms the product’s out surface, according to the difference of the construction, it has such kinds, whole style, whole inserting style, combining style, etc. The cavity is shown as Fig3.
2.2.2 The construction design of punch mold

Punch mold is the deformation component which deforms the plastic inner surface, in general, it has two kinds, one is the whole style, the other is the combining style. From the analysis of the plastic construction, there are three cores: one is the bigger core, shown as Fig 4, for the force coming from the plastic is bigger, so it locates the moving mold; the other are two same smaller cores, they can be regarded as pushing rods, their combining shown as Fig 5.

2.3 Calculation of deformation parts working size

Because the upper cover of mouse is the streamline shape, the two-dimension graph has difficult to describe, so the Pro/E is used to draw the three dimensional of the product and its’ mold, the datum simulation technology and experience design calculation are combined for optimization[4].

The pouring system and cooling system are designed according to the tradition. Fig 6, Fig 7 show the deformation components graphs which simulate the mold’s opening, the middle of the figures are the casting model of the product.
The whole manufacturing technology is as Fig8.

Fig8 Manufacturing process of plastic mold based on Pro/E

After the process is adopted, the mold design and manufacturing period will become short greatly, while the mold’s design and manufacturing is based on the system’s geometry model, so datum’s correction is assured. With the CAD/CAM technology further applying and numerical controlling tool’s popularizing, the technology route has many advantages and applied popular in the mold’s manufacturing field.

3 Drawing of assembly and parts’ graphs

Assembly graph is the reflection of machining design, it is the important basis of design and manufacturing. While assembly graphs express the mold’s working theory, parts’ installing matching relation and each parts’ main constructional shapes, the needed sizes and technology demands of fabrication, checking, installing.
Part graphs are the main technology files which will be sent to producing department, it reflects the designer’s ideals, they express the mechanical demands, they are the sources of manufacturing and checking (including parts’ constructional demands and possibility of manufacturing technology, reasonable demands, etc.). The part graphs sign the concrete sizes, tolerences and roughness.

Three dimensional model graph is as Fig9, part graphs are as Fig10, Fig11.

Fig9 3-D model assembly graph          Fig10 Cavity mold                  Fig11 Punch mold

Summary

Top cover of out-shell of mouse is a thin plastic product, the product’s appearance is beautiful, the parts’ shape are all designed as curves, the study analysis the characteristic by Pro/E, the software has higher power functions based on the parameterizing property, and can help solve the special problem. For obtaining the higher quality product, method combined datum simulation and experinicial design has discussed and studied the deformation rule of top cover of out-shell of mouse, thus shortening the whole mold’s design and manufacturing period, optimized the mold’s construction and technology parameters, cutting the mold’s testing times greatly, improving the working efficiency [5].

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