Utilizing Moldex3D MCM Solution to Successfully Resolve Defects and Improve Product Quality

TOMTOM

Customer: TomTom Asia
Country: Taiwan
Industry: Electronics
Solution: Moldex3D eDesign Package
Moldex3D MCM Module

Image Courtesy of TomTom Asia

Customer Profile

TomTom is the world's leading supplier of in-car location and navigation products and services focused on providing the world's best navigation experience. TomTom's products include portable navigation devices, smart phone apps, GPS sports watches, in-dash infotainment systems, fleet management solutions, and maps and real-time services, including the award winning TomTom HD Traffic. (Source: www.tomtom.com)

Executive Summary

This case features a major component of a PND product: a car mount. The part precision and strength are two essential elements in developing a car mount product since they will have a large direct impact on the functionality and reliability of the final product. As a result, how to control the precision and the weld line location is the key to success of this project. However, relying on traditional trial-and-error method and past molding experience solely in hopes of solving manufacturing issues, such as weld line, sink marks, warpage, etc. is quite a challenge and inadequate. Thus, TomTom resorted to the help of Moldex3D simulation solution by utilizing Moldex3D eDesign and MCM Module to validate their product and mold design and optimize the manufacturing processing. Through Moldex3D simulation analyses, TomTom was able to understand the filling behavior, and predict warpage and weld line formation of the original design prior to the actual production, making it easy to determine the appropriate manufacturing method and revise the mold and gating location design to successfully solve molding defects and improve the overall product quality.

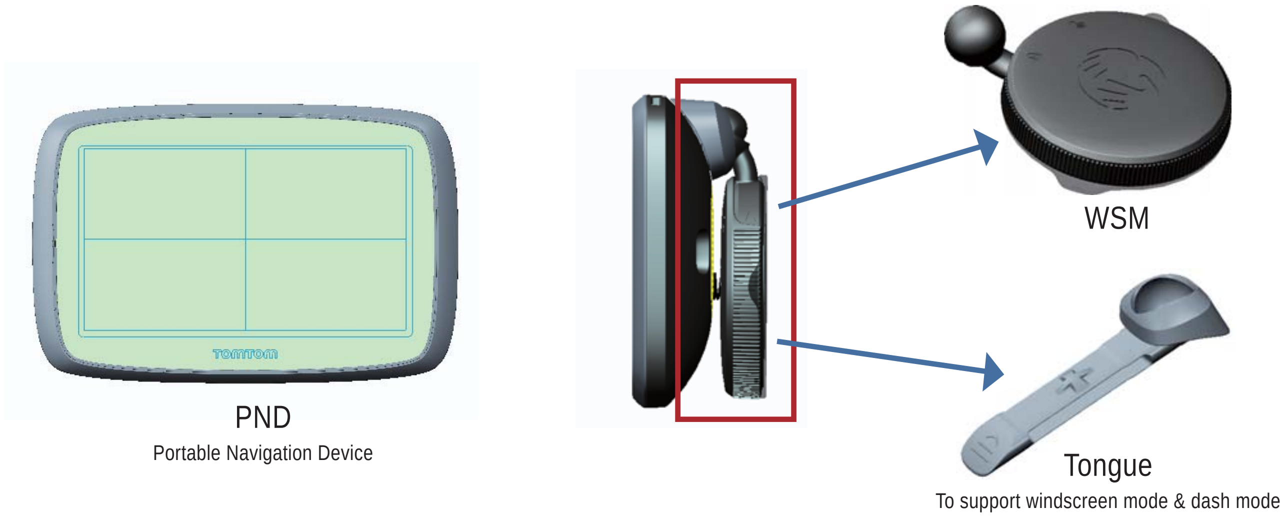

Figure 1: This case features a major component of a PND product: a car mount

Challenges

- ID design concern
  Core-out is not allowed in the socket area.
- **Structural strength concern**
  Weld lines cannot appear in the upper beam & socket areas.
- **Product aesthetic attributes concern**
  Due to thickness variation, sink marks might occur in the socket area, resulting in potential cracking in the area.
- **Dimensional accuracy concern**
  Due to uneven shrinkage, warpage might occur and the product precision might be compromised.

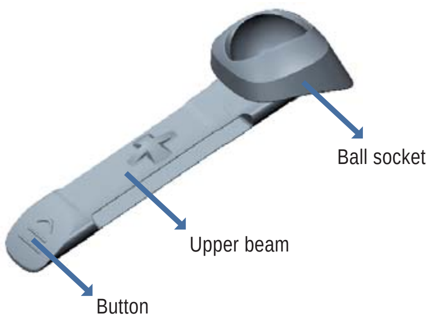

Figure 2: Part Design

Solutions

In order to ensure product quality and lower product development cost, TomTom utilized Moldex3D eDesign package and MCM Module to validate product and mold designs in the early product development stage.

Benefits

Product Quality Improvement:

- Sink mark elimination
- Weld line control to avoid cracking when in use
- Dimension control within spec.
- Shrinkage ratio improved by 45~60%
- Flatness improved by 40~50%

Production Optimization:

- Yield rate increase 40 %
- Material waste reduction and lower production costs

Case Study

Multi-component Molding (MCM) is one of the greatest methods to diversify the development of the plastic molded product fabrication. Applying this method in plastic product development allows greater design freedom and saves cost and time on multi-part assembly, making it one of the most widely used technologies in contemporary modern manufacturing world. Also, due to the requirements to meet the product strength and appearance standards, for some part designs, wall thickness cannot always be reduced. However, having a thick-wall design might lead to manufacturing difficulties and potential molding defects, and applying MCM technology in the production can be a viable solution for manufacturing thick-wall plastic parts.

In this case, TomTom utilized Moldex3D eDesign solution to simulate the molding scenario of the original design, using traditional injection molding method. Through Moldex3D eDesign simulation results, TomTom found out that using traditional injection molding method, sink marks and high volume shrinkage would occur in the main region of the part which might cause potential risks for product deformation. This molding defect would have a direct negative impact on product's functionality and physical appearance. Thus, in order to solve this problem and produce high-quality products with fine aesthetic attributes, TomTom considered applying an alternative manufacturing technology: Multi-component Molding (MCM), to produce this part.

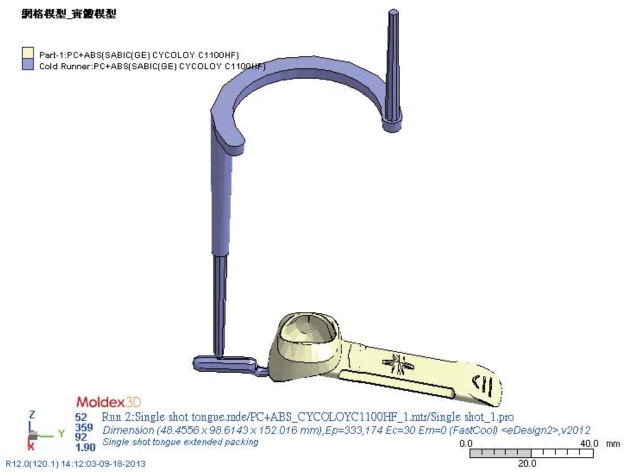

Figure 3: The Original Design
Using traditional injection molding method

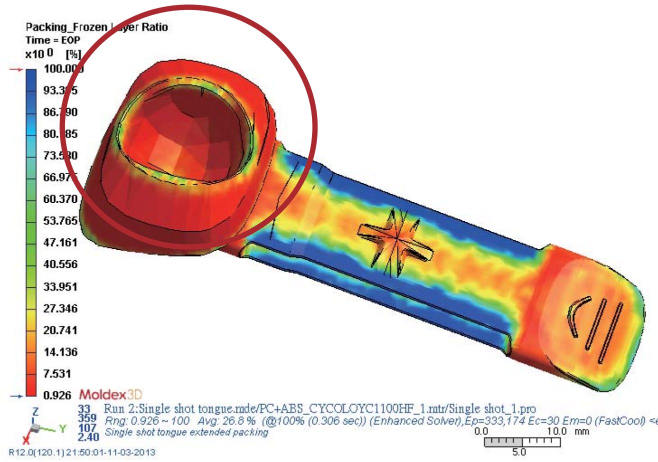

Figure 4: The Original Design¬_Packing Analysis- Pressure
The Heat accumulated in the thick-wall area and the high volume shrinkage was observed in the area.

Secondly, TomTom utilized Moldex3D MCM module to simulate double-shot molding while using the same material and determine the best option for product/mold design. Via the Moldex3D MCM analyses on the Revised Design I, TomTom was able to detect a flow hesitation phenomenon in the filling behavior which would lead to the undesirable weld line formation. Plus, the weld line location was in the essential region of the part, the socket region which made the area vulnerable to cracking when in use.

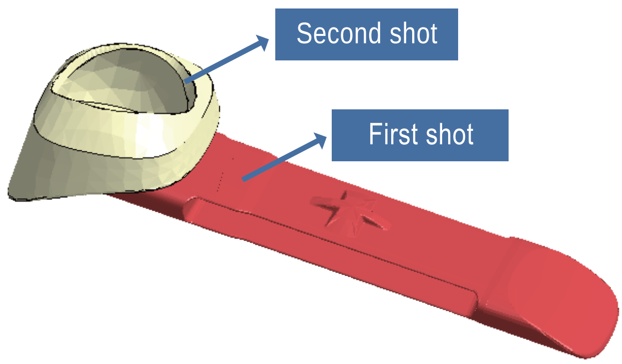

Figure 5: Revised Design I.

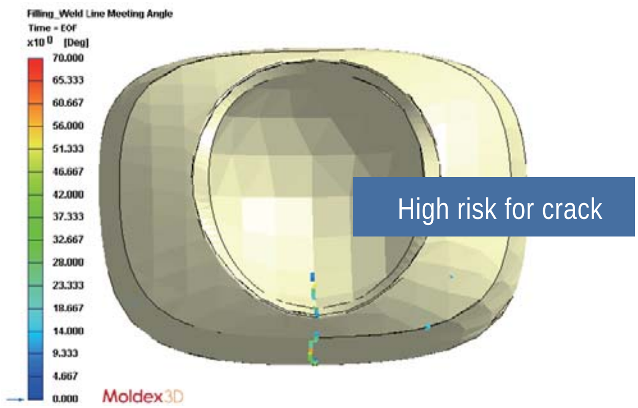

Figure 6: Revised Design I. _Filling Analysis- Welding Line
The weld line location was in the undesirable area, making it vulnerable to cracking when in use.

Next, in order to eliminate weld line formation in the socket region and avoid cracking when in use, TomTom proposed a new design by reversing the first and second shot sequence while still using the same material. Also, the gate location was changed. According to Moldex3D MCM simulation results, the new design: Revised Design II was able to effectively resolve weld line issue and improved the overall warpage displacement significantly; thus, making it the most ideal option for design change and optimization.

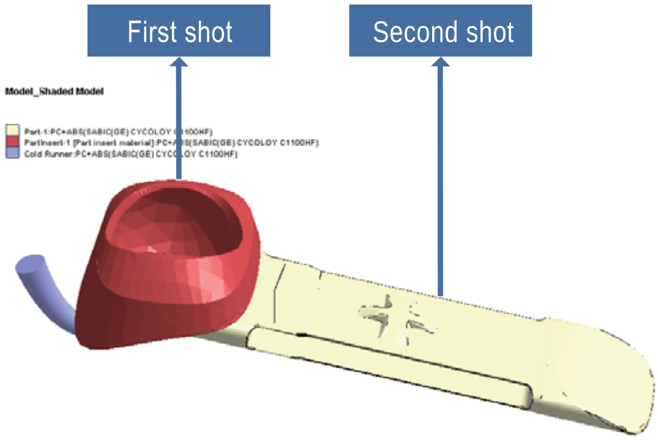

Figure 7: Revised Design II.

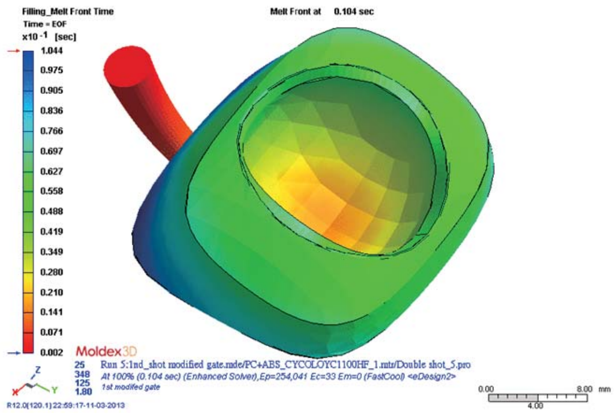

Figure 8: Revised Design II. _Mold Front Behavior
No visible weld lines in the socket region.

Lastly, TomTom conducted an actual mold-trial experiment. When comparing the actual mold-trial results with those of Moldex3D simulation analyses, the simulation results closely reflected the real-life molding scenario and were validated by the mold-trial results. Thus, through Moldex3D eDesign and MCM simulation solutions, TomTom was able to effectively solve product deformation issues, improve product quality and maximize its aesthetic appeal to meet with the stringent product requirements.

Figure 9: Moldex3D simulation analysis accurately predicted molding defects would occur in the socket region in the original design (left) and it was validated by the actual mold-trial result (right).

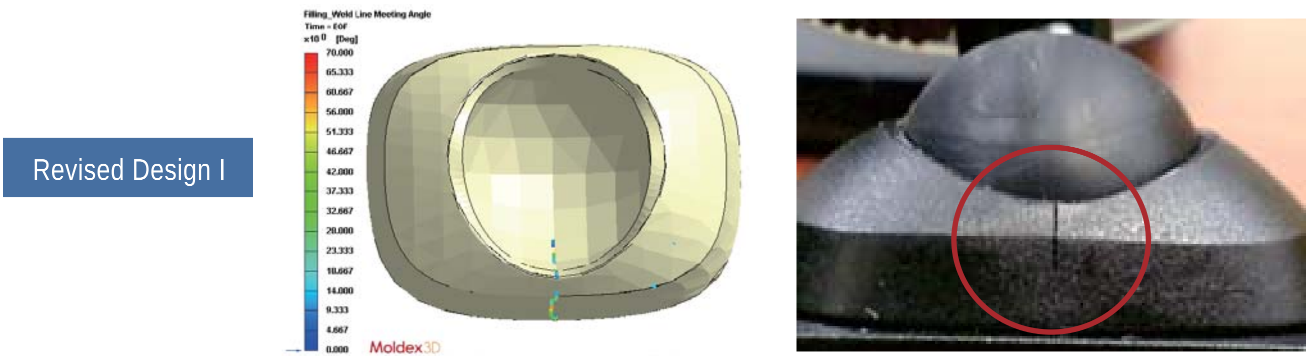

Figure 10: Moldex3D simulation analysis accurately predicted the weld line location in the socket region (left) and the cracking on the product surface was observed in the mold-trial result (right).

Results

Through Moldex3D analyses, TomTom could clearly understand the filling behavior and predict potential manufacturing difficulties prior to the actual production. The accuracy of Moldex3D simulation analyses were later validated by the actual mold-trial results. In the end, TomTom was able to successfully solve manufacturing issues, optimize product and mold designs and achieve the most optimal results.

Image Courtesy of TomTom Asia

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