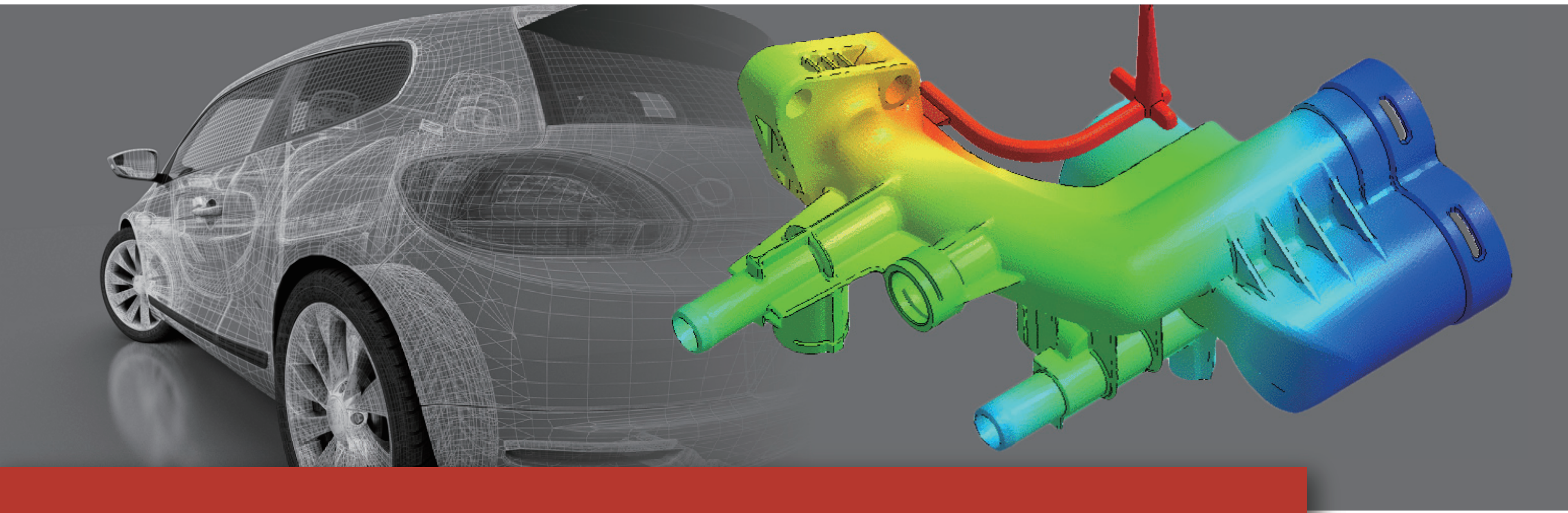

KOPLA's Method to Reduce Cooling Time of Automotive Thermostat Housing

Customer: KOPLA
Country: Korea
Industry: Plastic Material
Solution: Moldex3D Advanced Package; Flow, Pack, Cool, Warp, Fiber, FEA Interface, MCM

KOPLA has been developing and supplying the composite materials for the automobile industry since 1997. They have been dedicated to developing eco-friendly material such as PPS, PPA, and PCT in 2013. This allows for the expansion of lighter materials, including carbon fiber reinforced composite, high heat resistance materials, and high strength materials. (Source: http://www.kopla.com/)

Executive Summary

Many molders use HTN (High-Temperature Nylon) in automotive thermostat housing. Nowadays they are facing the challenge of reducing cooling time because HTN material is injected under very high mold temperature and melt temperature.

KOPLA's purpose of this analysis is to reduce the cooling time of thermostat housing and to help customers inject the part with optimized injection parameters and cooling lines. Moldex3D cooling analysis first pointed out that the required cooling time was overestimated in the original setting. Moldex3D also helped to validate the design revision on the core material and cooling line to further reduce the required cooling time, which is approved by the report of the customer.

Challenges

- To reduce the cooling time
- To help customer inject the part with optimized molding parameters and cooling lines

Solutions

Utilizing the machine mode analysis of Moldex3D for more realistic approach of the real case and running Moldex3D cooling analysis to estimate the actual required cooling time

Benefits

- Reduce the cooling time from 85sec to 28sec by running Moldex3D cooling analysis successfully
- Moldex3D machine mode interface can match the customer’s environment for realistic analysis results
- Understand the influences of parameter changes

Case Study

KOPLA had to reduce the cooling time (the original setting was 85 sec) during manufacturing of a thermostat housing component, but still ensure sufficient cooling to prevent part failure caused by high temperature. Moldex3D machine interface was utilized for cooling analysis and cooling line layout design to approach the actual molding process, validate the original setting and design revision, and obtain required cooling time (Fig. 1).

Item	Value	Unit
Cooling method	General	-
Initial mold temperature	190	oC
Air Temperature	25	oC
Eject Temperature	230	oC
Cooling Time	85	sec
Mold-Open Time	15	sec
Mold preheat	Setting	

Channel ID	T (oC)	Q (cm^3/sec)	Coolant	D (mm)	Re
EC1 (Group 2)	190	120	Oil	16	3285.28
EC2 (Group 3)	190	120	Oil	16	3285.28
EC3 (Group 4)	190	120	Oil	16	3285.28
EC4 (Group 5)	190	120	Oil	12	4380.37
EC5 (Group 7)	190	120	Oil	16	3285.28
EC6 (Group 1)	190	120	Oil	12	4380.37
EC7 (Group 8)	190	120	Oil	16	3285.28

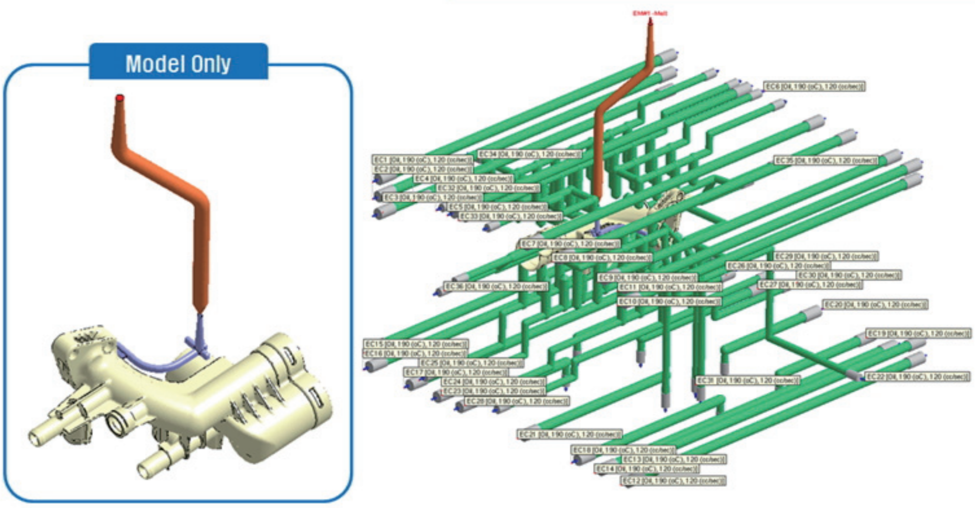

Fig. 1 The process conditions and cooling line desingn of the thermostat housing component in this case

Starting with validation using Moldex3D, it was found that the original 85 sec cooling time was too long for the part to cool down enough (80%) (Fig. 2). After changing the core (insert) material (Fig. 3) and extending the baffle length in the cooling system (Fig. 4), KOPLA found the required cooling time should be less according to Moldex3D’s analysis results (Fig. 5).

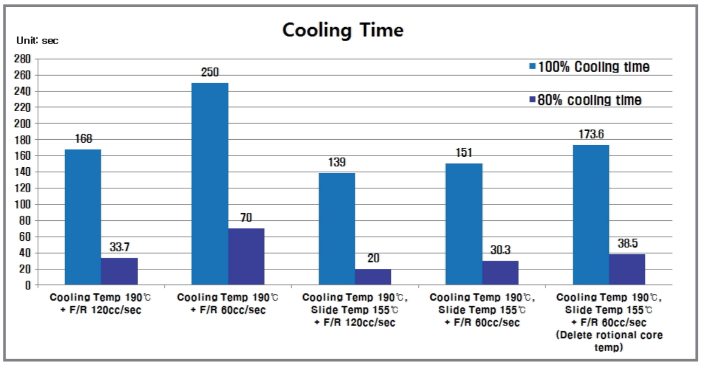

Fig. 2 The estimated cooling time with different cooling contitions

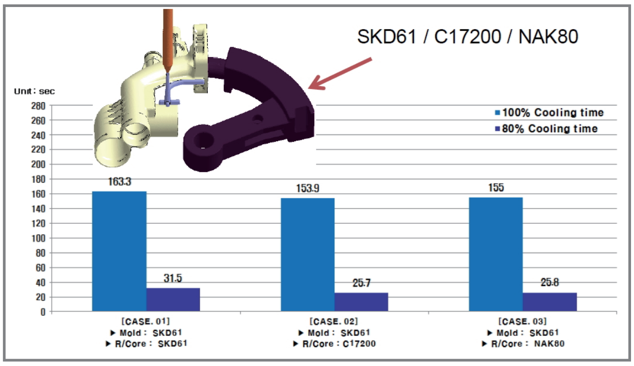

Fig. 3 The estimated cooling time with different core materials

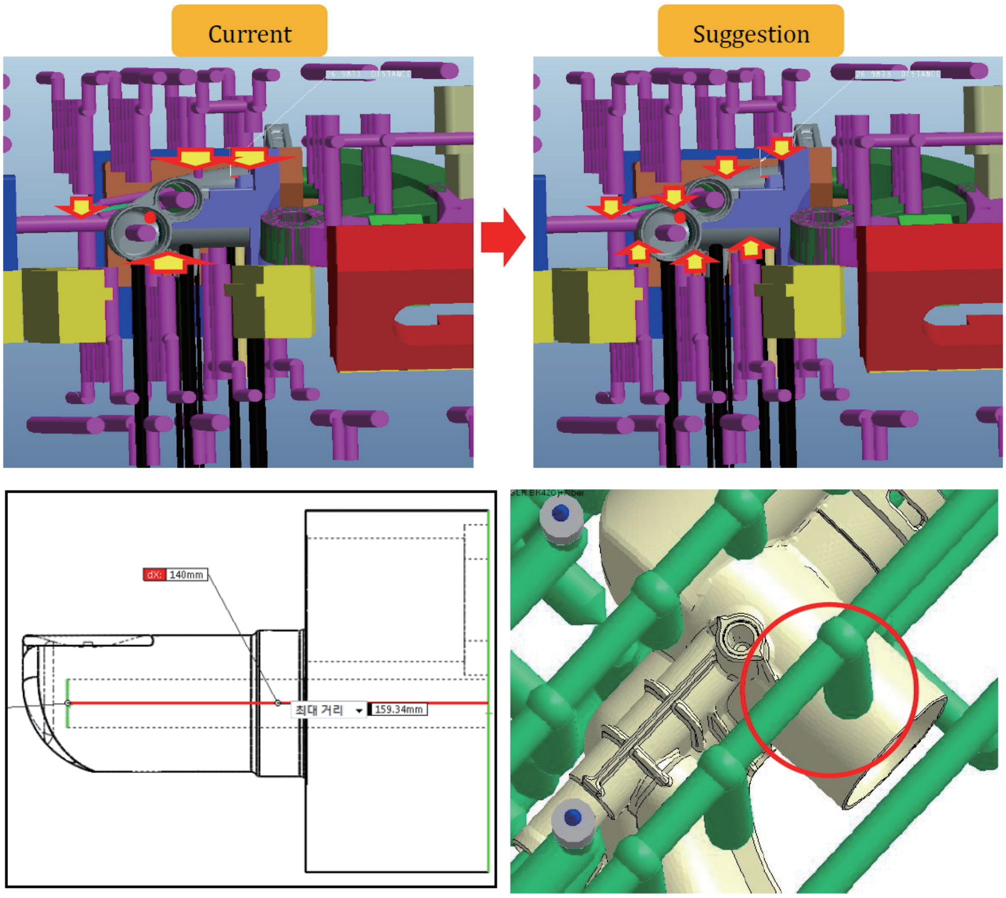

Fig. 4 The design revision of the baffles in cooling liines

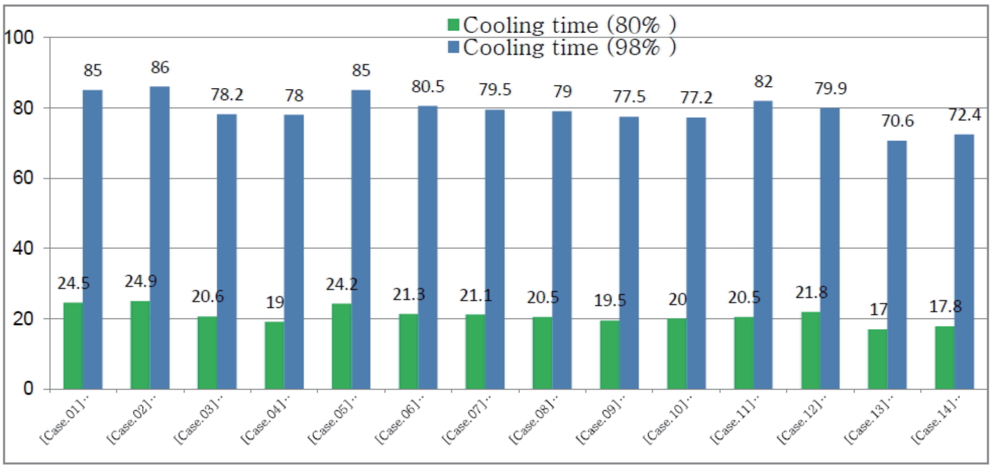

Fig. 5 The estimated cooling time with different combinations of design revisions

By using Moldex3D cooling analysis to verify the required cooling time for both the original design and modified design with different settings of cooling lines and core materials, KOPLA found that the cooling time could be reduced from originally 85 sec to nearly 28 sec. This greatly saved the expense during manufacturing.

Results

Besides decent cooling analysis, Moldex3D can provide nodal temperature source after cooling to other fluent analysis software. Moreover, the machine mode interface of Moldex3D can approach the real manufacturing cases. The KOPLA customer in this case was also very satisfied with the performance of Moldex3D and planned to include Moldex3D in their internal process such as cooling before mold tooling.

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