Use scientific solution to optimize the product's cross section to reduce the deflection

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- - § Enterprise introduce
 - § CAE team introduce in Minth
 - § Optimize product's cross section to reduce the deflection
 - § Comprehensive solution to reduce the deflection
 - § Project summary
 - § Application experience share
 - § Look forward to the future

Enterprise introduce

1-1 Minth Group History



1-2 Business Growth



持续稳健增长和营业结构优化。



(数据截至2016年底)







Enterprise introduce

1-3 Minth's Global customers



1-4 Main Product line





CAE team introduce in Minth



CAE team introduce in Minth

Item	Analysis type	
	strength and stiffness	
	Vibrate	
Structural	Impact	
strength analysis	Conquassation	
	Fall	hs
	Optimize	
	Fatigue	
	Weld	
	Rivet joint	
	Bend	(2) Over-crow
Molding process	Rolling	2 Molding p
analysis	Composite material	
	Stamping	
	Moldflow +	Ł
 	Co-simulation	1
Motion analysis	Mechanism motion simulation	

Molding process

Deflection, all effects:Z Component Scale Factor = 3.000

dз

d5

--·一次预变 --·二次预变

rocess

[mm] 14.87 💼

9.570

4.271

-1.028

-6.327

	工艺成型表											
项目名称	项目名称 装饰框							ş		1		
注意机型号	100-20-7- 200-100 注明相利-B HTF1600/800W2							#14.00-0 /			P1608	2
注意成型	社設成到工艺表:											
注射时间		4.5	5	保压	时间		17.7		冷却时间		29.0 s	
成型周期		51.2	5	烙体	温度		250	ť	V/P转换			95.4 %
20 0 A+ 61	产品	103.0	cm²			前標	70	đ	A AN A ST IN	前棋		57 10
/ PRINCI	液口	15.0	cm ³	08299	ax	后楔	70	10	17 SU // COLOR	后棋		57 10
		往	Ħ				_		保	Æ		
	/	起始位置 /mm	注射 /M	压力 [pa	注射	速率 %		~	保压压力 /Mpa	保馬 /	速率 %	保压时间
射出一.	8	/			11	.7%	保圧一	段				8.5
	R	59.8			5.	0%	保医二	段				2.2
射出三	20	59.3			13	.6%	保田三	殷				7.0
射出四	<u> 70</u>	29.5			9.	4%	保田四	殷				
射出五	8	21.0			5.	8%	保压五	段				
射出六	R R	17.3										
射出セ	射出七段											
射出八	8											
螺杆杆:	5	18.5	mm		救余₽	2	20.0 mm 注射:			2 38.5 mm		
是否为闲意	注意]7						0 2					쥼
燕流道阀门	控制	8时间/s									4	注
Gate_	L	1 [#] Open	0.0	1" (lose	2.9	2 nd Open	4.1	2 nd Close	17.5		
Gate_	2	1"Open	2.9	1" (lose	22.0	2 nd Open		2 nd Close			
Gate_	3	1 ^e Open		1" (lose		2 nd Open		2 nd Close			
Gate_4	1	1 ^e Open		1*0	lose		2 nd Open		2 nd Close			
Gate_	5	1"Open		1*0	lose		2 nd Open		2 nd Close			
Gate_(5	1"Open		1" (lose		2 nd Open		2 nd Close			
Gate_	7	1"Open		1"0	lose		2 ^{re} Open		2 ^{re} Close			
Gate_2	5	1"Open	-	1"0	lose		2 ^{re} Open	-	2 ^{ne} Close	-	-	
Gate_9	,	1"Open	-	1"0	lose		2"" Open		2 [™] Close	-	-	
Gate_1	0	1"Upen		1"0	lose		2 ^{re} Open		2 Close			
		G1	F	52	t		1		7 61			
					G	12				C		灰色为结耳双

Case introduce

D Body side molding on Automotive

Molding Material	ABS 430
Part Dimension	514*41*27mm
Main Thickness	2.7mm
Surface Treatment	Chrome

Five plastic clips

Three metal self-tapping nails.

Case introduce

- Part size is OK after assembly.
- There are defect like sink mark on the opposite surface of metal selftapping on both ends after temperature cycle.
- The main reason is the high deflection for in the free state. The clips and nails hold back the deflection so the deflection transfer to the residual stress and stored in the product and affect the appearance of the product surface after the temperature cycle.
- By reduce the deflection within 1.5mm in free state to remove the residual stress.

Original mold design



Original mold design



The practice molding condition

output

	nin	TH)	注塑成型条件表 987-09-28														
																版	本: 1.0	
	模具	【名称			产品	产	品件	号 产品重量(*	↓美重量(g)	材料名和		弥/规格			
		/		/				/ 左: 59.7±2 右: 59.2±2			:2 :2	0	ABS 430		430			
	注塑	机型号		周期	时间(s)	标准产育	분/h	/h 锁模力Tupa			材料干燥温度℃			材	料干り	鄵时间h	
	HI	F650			50		65sets/	h 7±2			80 ± 2			≥2				
温度	1	2	3		4		5	6			1			动模模温机器	国家で	定模核	温机温度で	
۶ C	220	215	21	0	205	200			1		2	60				50		
	1	2	3		4	5		6	阀门	控:	3							
热流	220	220	22	0	220				制时间		4				_			
坦圧 度10	7	8	9		10	- 11		12 S 5		5				注塑机油温℃		油温℃		
									1		6					20-	-55	
			起始(≹≣mm	压力	Bar	速度	%				_	Æ	力Bar	速度	₹%	时间S	
	射出	一段			75		10			保	E-F	<u>2</u>		45	1	0	2	
	射出	二段	Ę	56	95		45			保	БШ	<u>2</u>		70	1	0	4	
射	射出	三段	÷	33	80	1	20		保	保	ΕΞ	<u> </u>						
出	射出	四段	ŝ	25					一 压 保		压 保压四段		保压四段					
	射出	五段	2	25							保压五段		2			_		
	射出	六段	2	25		_				(n cr.+		≿_≠		位里	注塑	时间	2.1	
	射出	终止	2	25		1		1			र1 स / ¶	720		илш	冷却	时间	30	

Filling balance	ОК
Injection pressure	99 Mpa
Pressure in cavity	55 Mpa
Packing pressure	45Mpa 2 s 70Mpa 4 s
Coolant temperature	Cavity: 50 °C Core: 60 °C
Cooling time	30 s
Temperature difference in the cavity	≈5.5°C
Temperature difference in the Core	≈7.0°C
Cavity/Core temperature difference	≈10.0°C

The deflection reason investigate





For flexible product, normally the deflection in simulation will much bigger than the experiment.

Item	Deflection in practices	Deflection in simulation	Target	
Deflection	8.6mm (A) 3.5mm (B)	14.4mm (A) 6.9mm (B)	<1.5mm	

The deflection reason investigate



The improvement solution



The improvement solution





Item	Deflection in practices	Deflection in simulation	Optimize 1	Target
Deflection	8.6mm (A) 3.5mm (B)	14.4mm (A) 6.9mm (B)	12.7mm(A) 6.2mm(B)	<1.5mm

Optimize product's cross section to reduce the deflection

□ For single cross section part that 3 mm in the thickness and 300 mm in the long.



- Product centroid
- Product volume shrinkage centroid

Optimize product's cross section to reduce the deflection



Notes:

- **r** : The radius of curvature of the beam
- M : Bending moment
- E : Elastic modulus
- I : Inertia moment



Cross section adjustment

X axis : The direction of biggest inertia moment.

Y axis : The direction of smallest inertia moment.

Build the coordinate based on the shape of product's cross section, then the thickness need to be changed is determined to reduce the deflection.



18

Optimize product's cross section to reduce the deflection



1.200 -

B6718

Frozen layer fraction:XY Plot

Optimize product's cross section to reduce the deflection







Experiment after optimized the cross section



Optimize product's cross section to reduce the deflection



Material	ASA XC180
Product size	234.6*130.3*33.2mm
Normal thickness	2.5mm
Surface finish	Grain





Cross section adjustment



Optimize product's cross section to reduce the deflection



experiment.

Optimize product's cross section to reduce the deflection



Comprehensive solution to reduce the deflection



Over-crown + **Cross section optimize**

□ Molding of door fender on Automotive



Over-crown + **Cross section optimize**







Split — Split the complex part to a series of long and thin units with simple cross section, to find out the primary reason and related improve solution.







Project summary

- Confirm the magnitude of deflection improvement by each solution through summary each case study.
 - Gate location, gate size
 - Molding condition / Packing profile
 - Cooling circuits
 - Over-crown
 - Cross section optimal
- For the part using <u>non-filled</u> material, the best way to reduce the deflection is to adjust the thickness in right area.
- Use comprehensive solution to reduce the deflection

Project summary



Application experience share









Look forward to the future

Customize develop program to quickly analysis the deflection in simple way



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