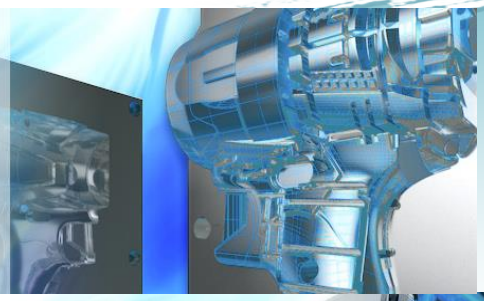
OPM Technology

OPM laboratory Co.,Ltd.

OPM technology

Laser melting combined with milling technology
for mass-production



Conformal cooling design technology

The most efficient use heat exchange
and energy saving

CAE technology

Prediction of molding condition
before and after completion

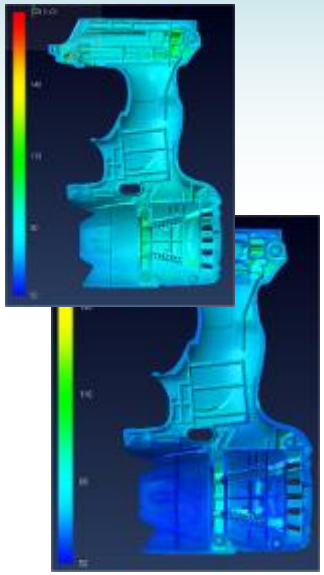
Hands on practice as software maker and developer

The most capable producers in the world

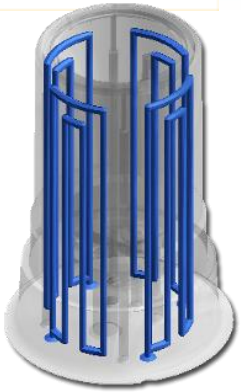
Produce tooling for the most efficient heat exchange and energy saving

CAE technology

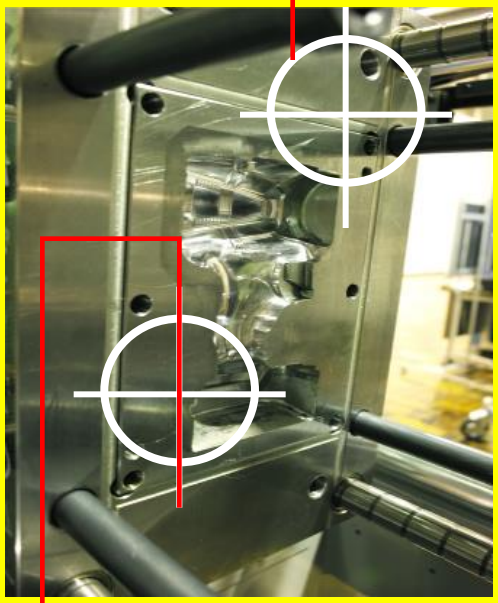
Thermal analysis

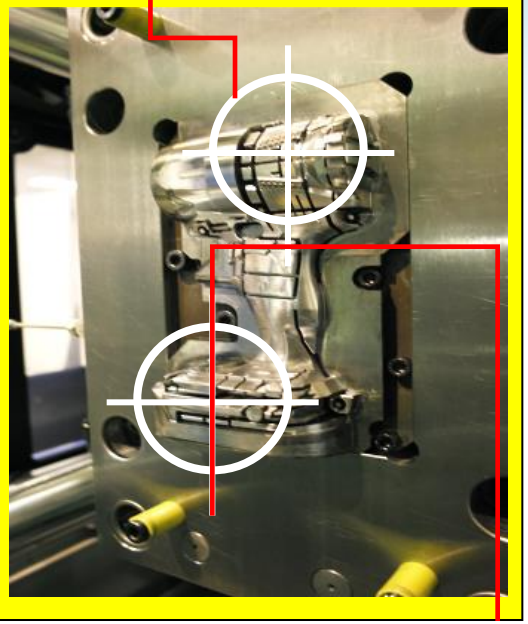


Conformal cooling design and produce technology



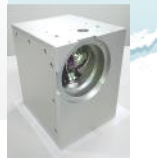
The 4 points feature of our production



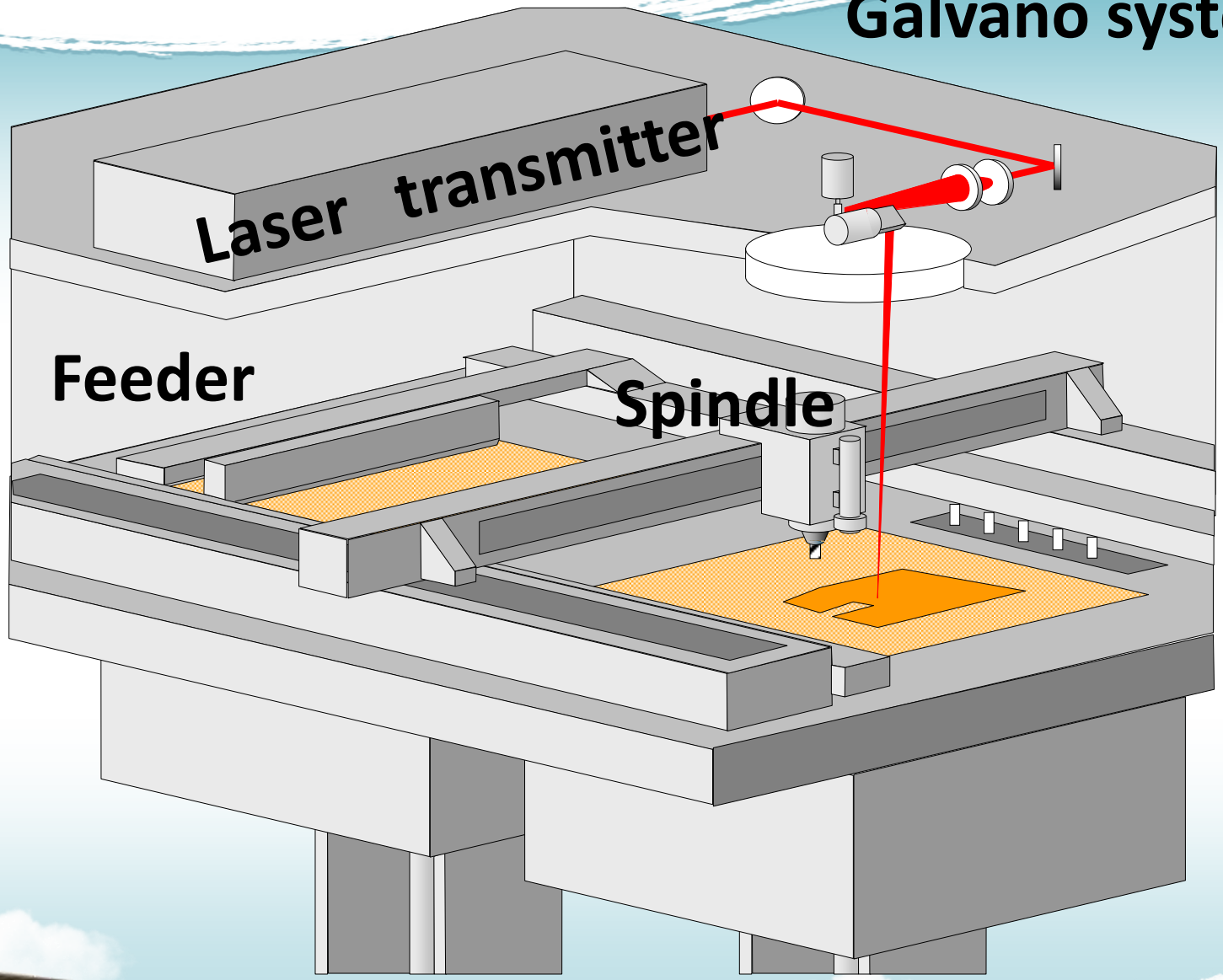


The most capable production in Asia

Hands on practice as software maker and developer



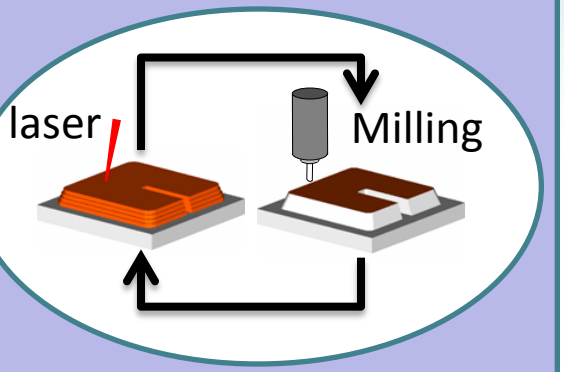
laser melting with milling

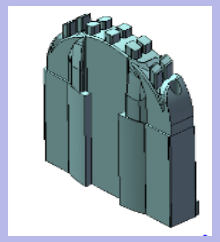


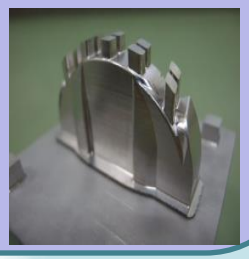
laser melting with milling

You can choose from 3 ways.

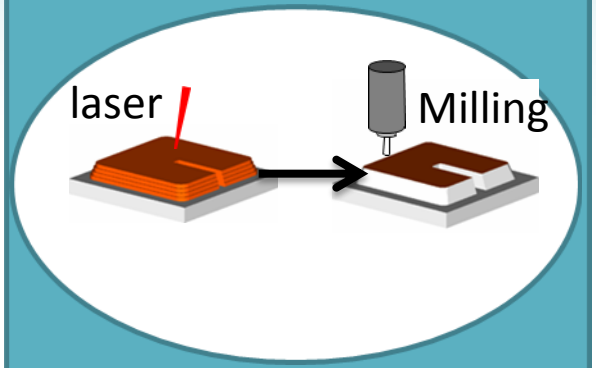
Laser melting and high speed milling

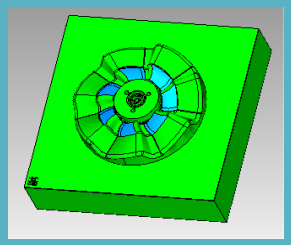




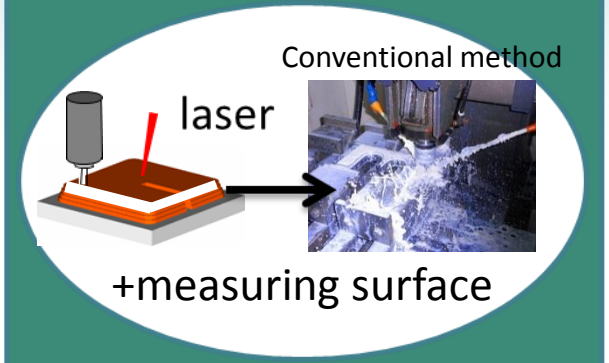


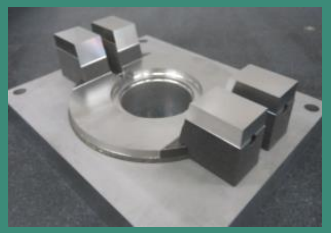
Milling following laser melting in sequence without dismounting

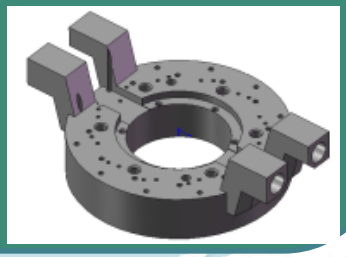




Sintered object + measuring surface for the following process

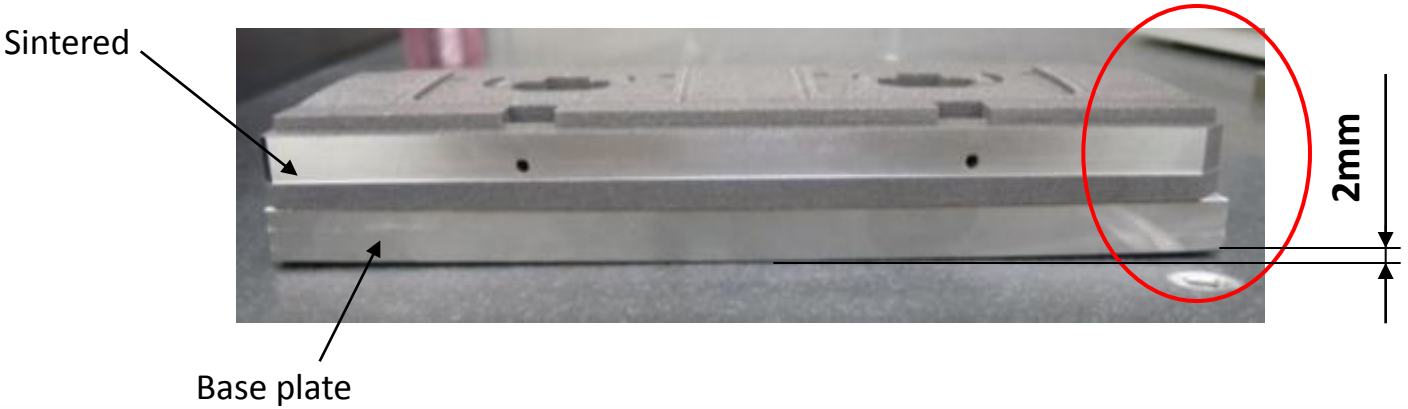




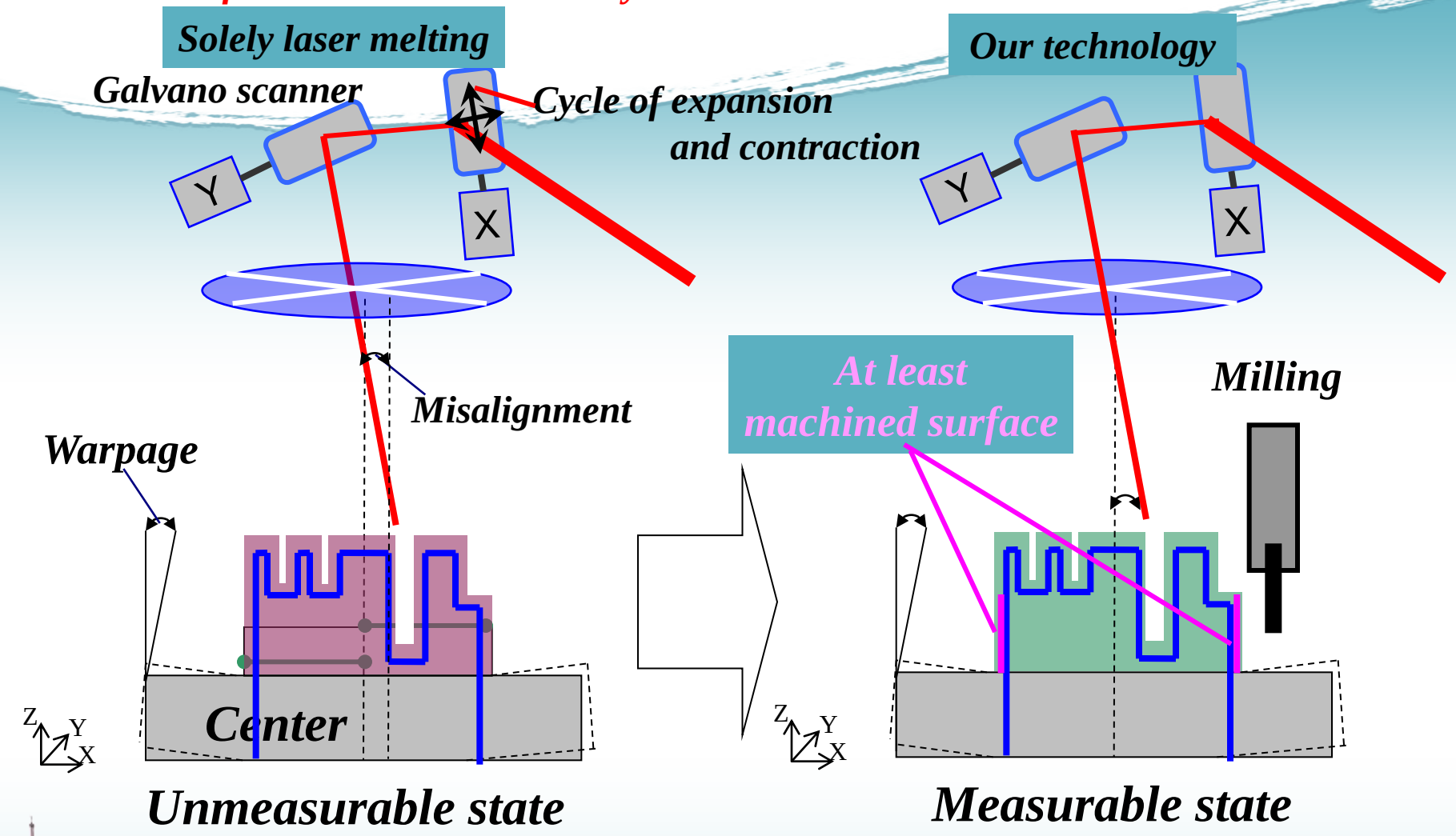


Warpage problem

Case example 2 : Core for connecter (210mm × 210mm)



✓ *Before sintered object is dismounted from machine, machined surface has to be made ready at the same time*



✓ *Misalignment between cad data and sintered object on condition that is used galvano*

✓ *The base plate and sintered object are warped by inner stresses.*

✓ *It can't measure accurate dimensions from fiducial surfaces of the plate*

Our technology (Comparison)

Optimized 3d model

- surplus area
- machined surface
- linear coefficient of expansion

Set base plate
- flatness measurement

SLM＋Milling
- machined surface

Measure sintered object on machine

measured result

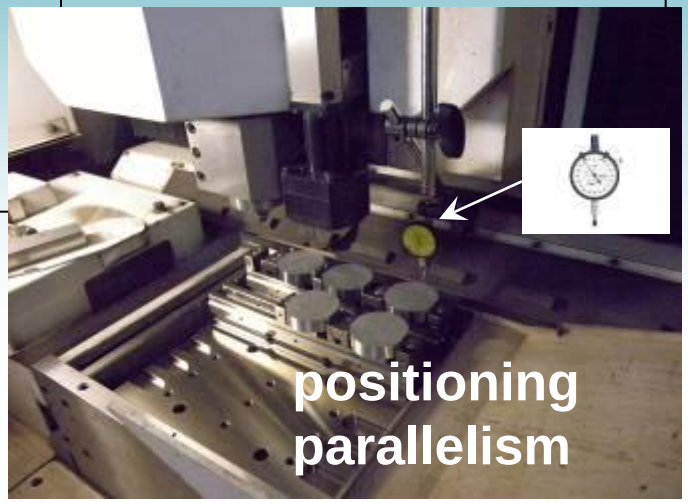
Heat treatment

Measure

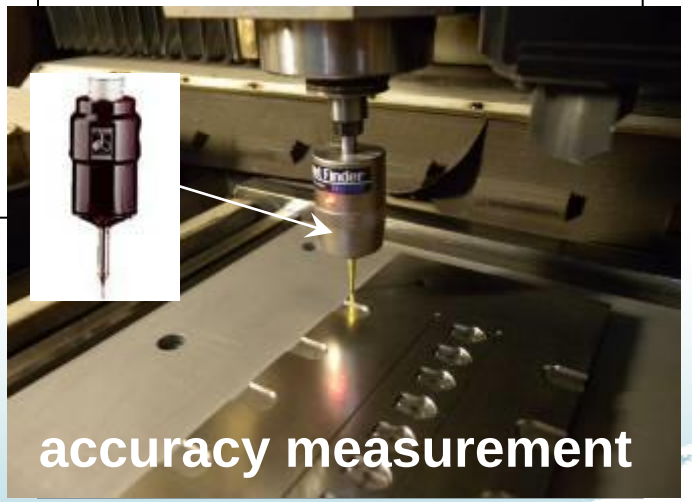
measured result

The following process

flatness measurement on LUMEX

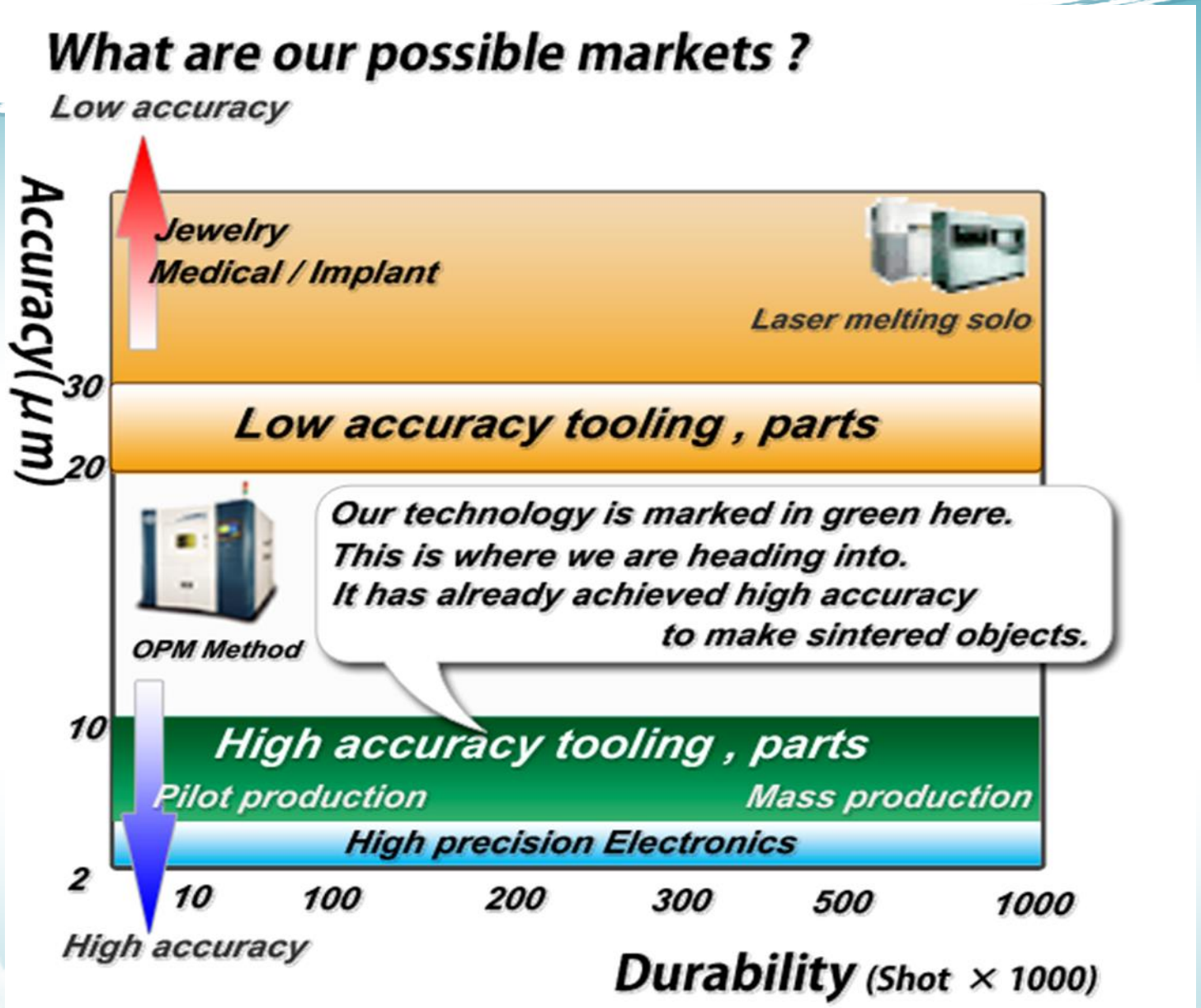


Measure on LUMEX



✓ Suitable for high accuracy part

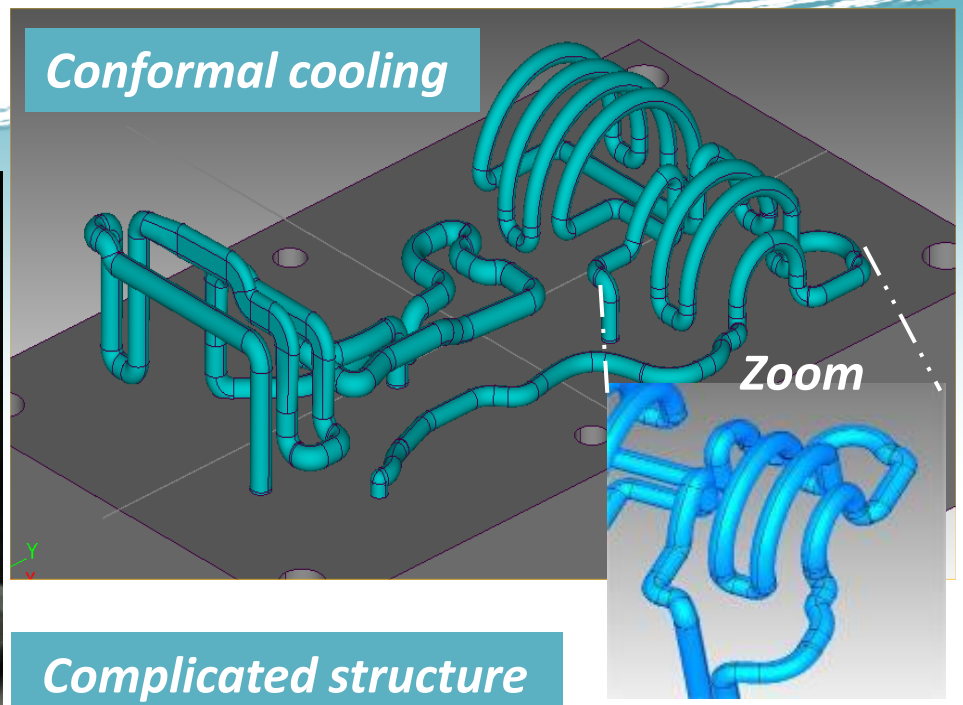
Our technology (Comparison)



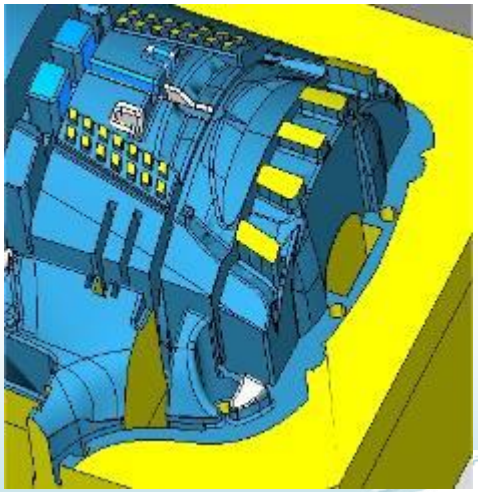
Our technology (Comparison)

Method	Laser Melting	On machine All surface with milling (Partially surface)	On machine measure
OPM technology	Possible	Possible	Possible
Laser melting solo	Possible	Impossible	Impossible

Case example of impact driver
(material : YAG Hrc52)

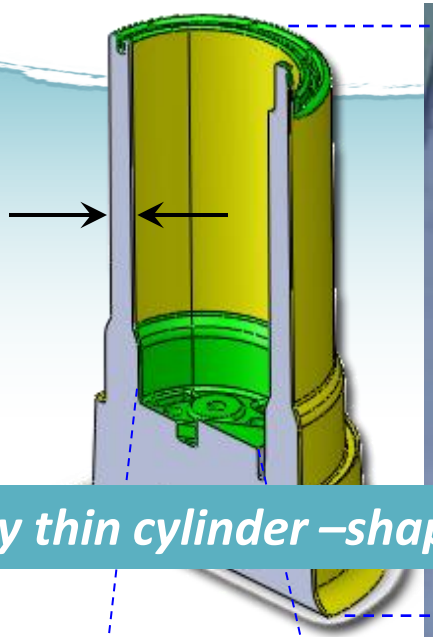


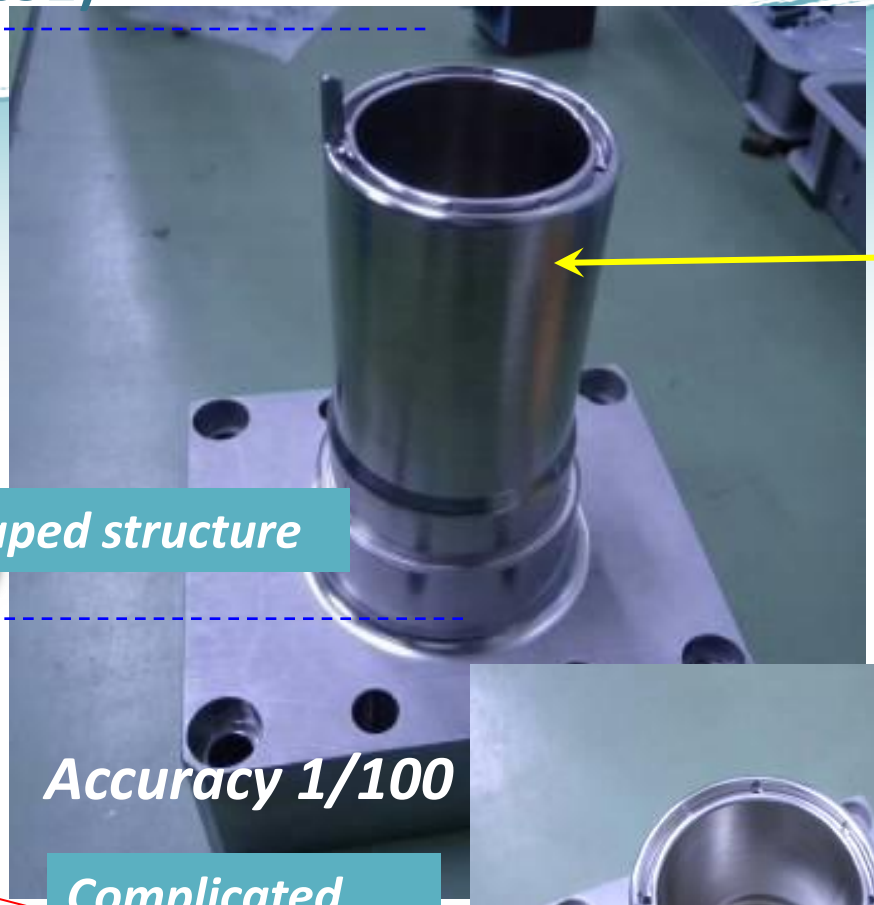
Complicated structure



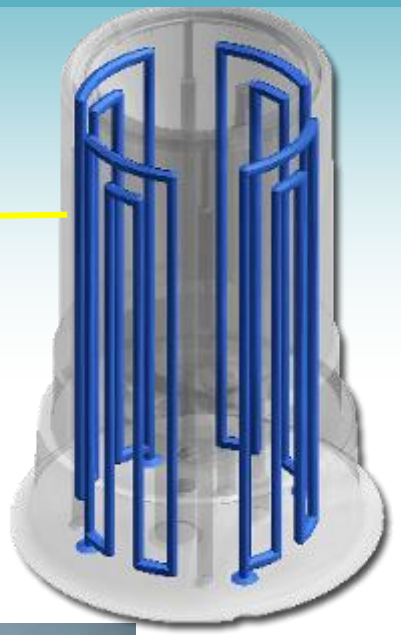
Case sample of automobile tank core

(material : YAG Hrc52)

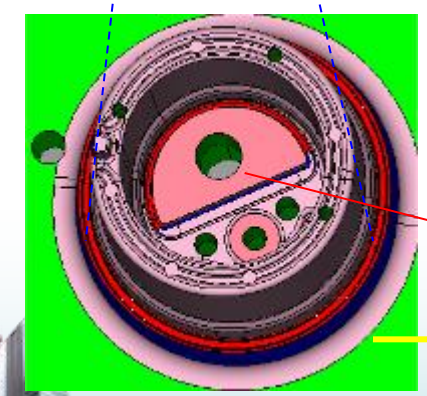




Conformal cooling

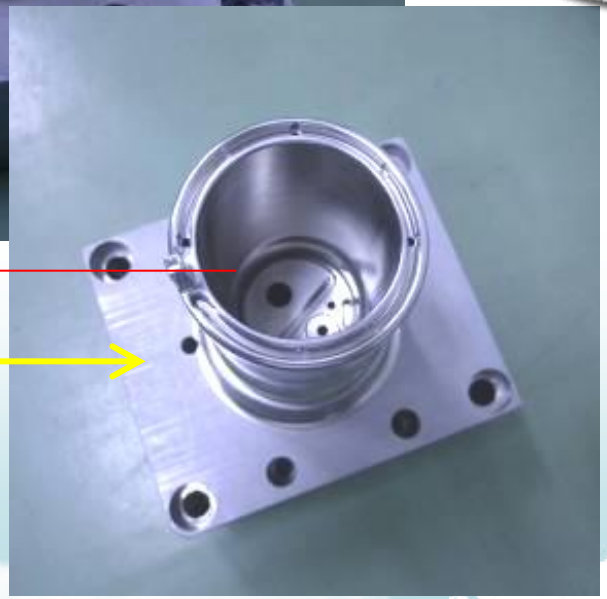


Very thin cylinder –shaped structure



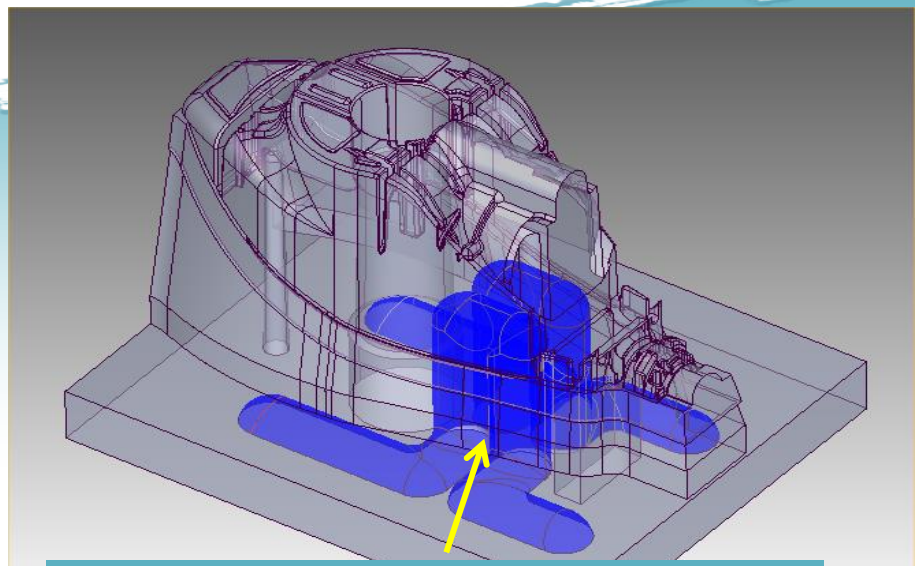
Accuracy 1/100

Complicated inside structure

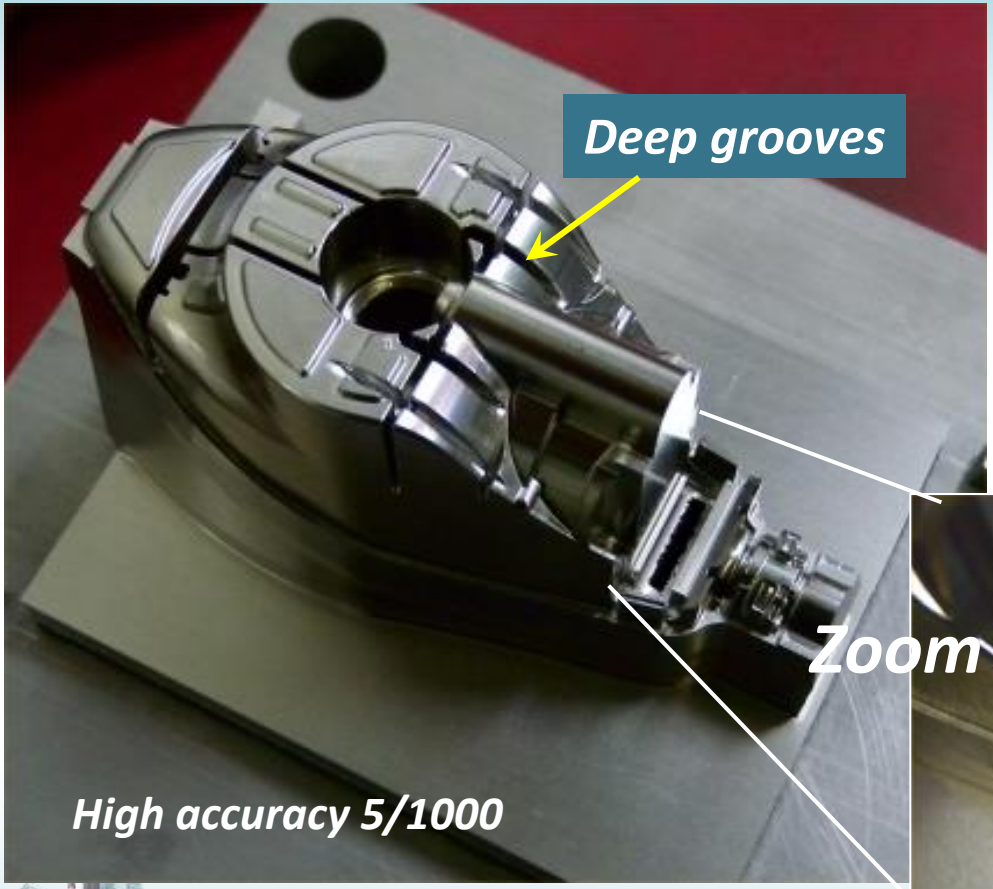


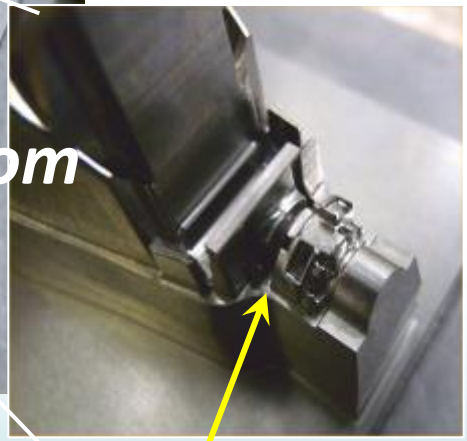
Case example of air refresher's bottle core

(material : YAG Hrc52)



Conformal cooling channel



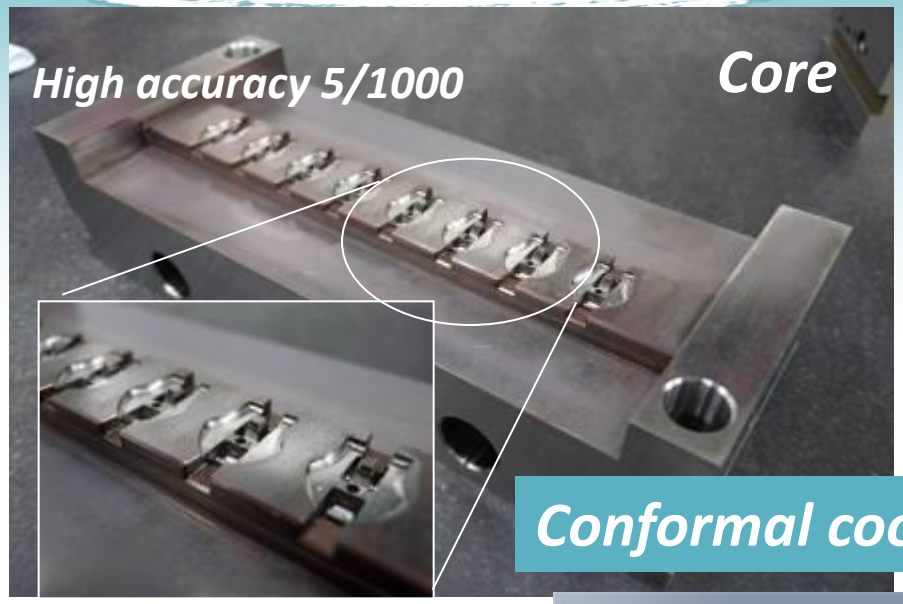


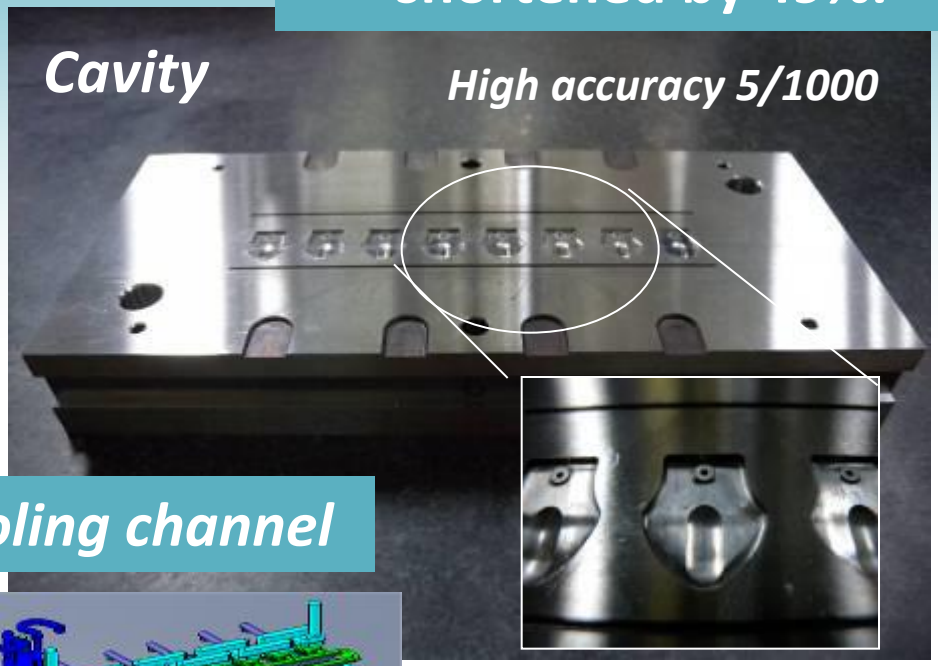
Complicated structure

Case example of zipper core

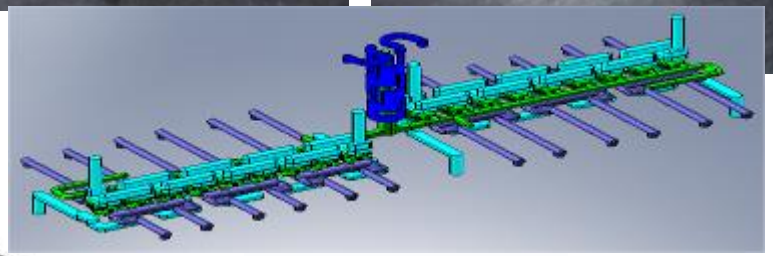
(material : YAG Hrc52)

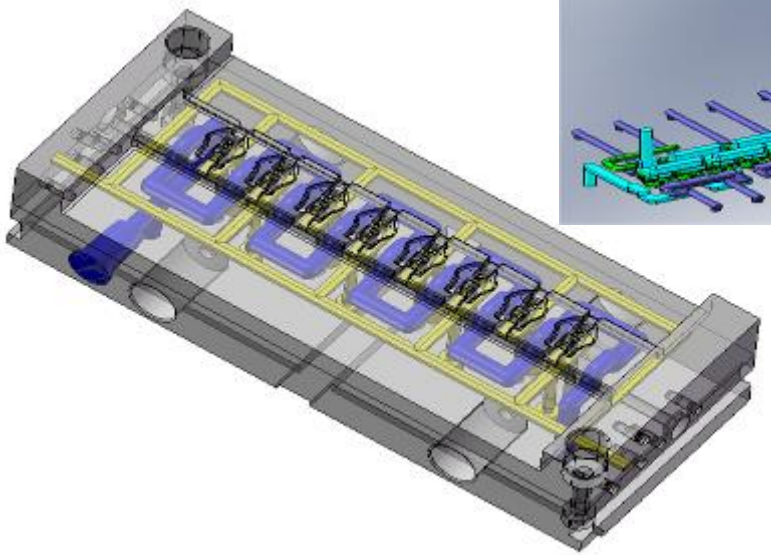
The cooling time can be shortened by 49%.

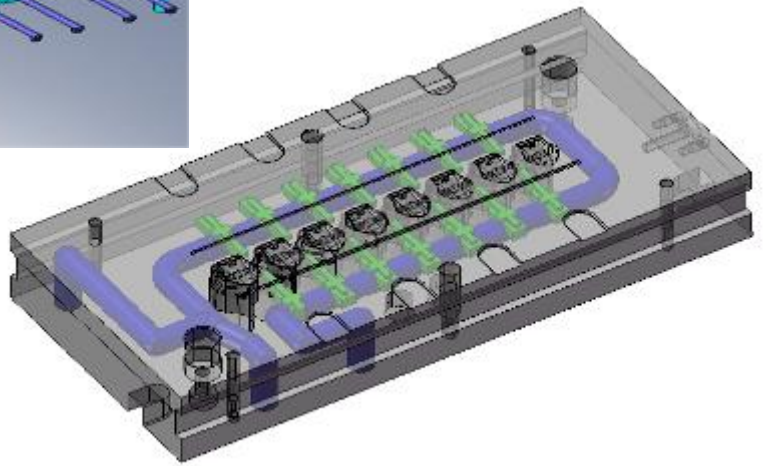




Conformal cooling channel

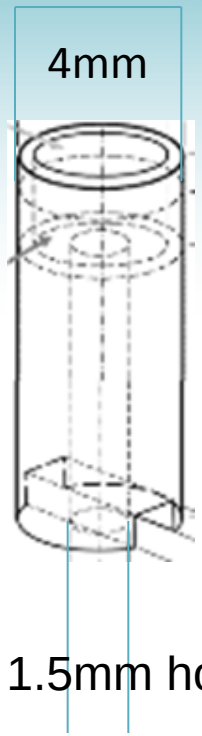


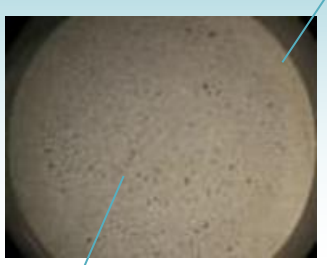


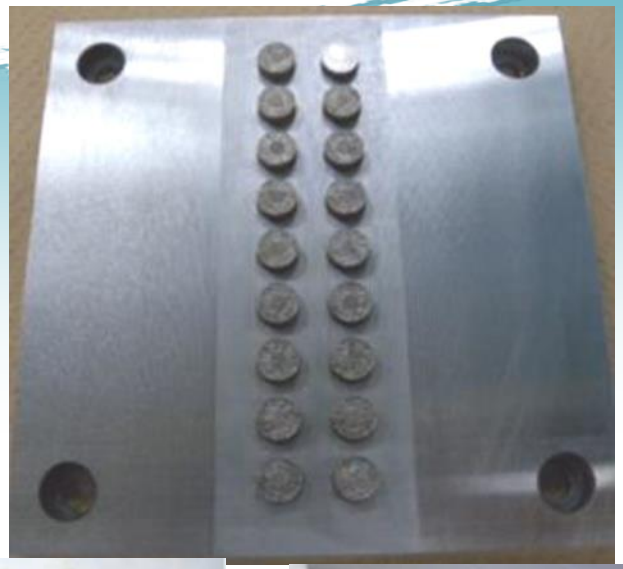


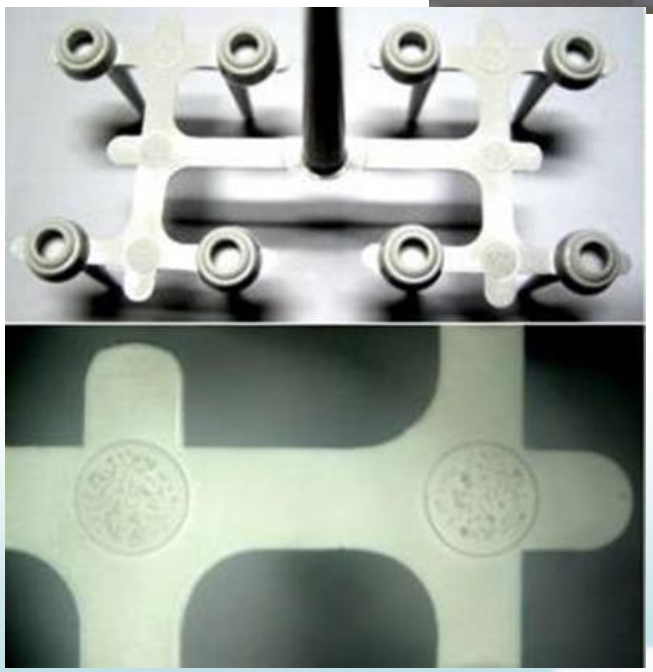
Case example of porous pin

(material : YAG Hrc52)



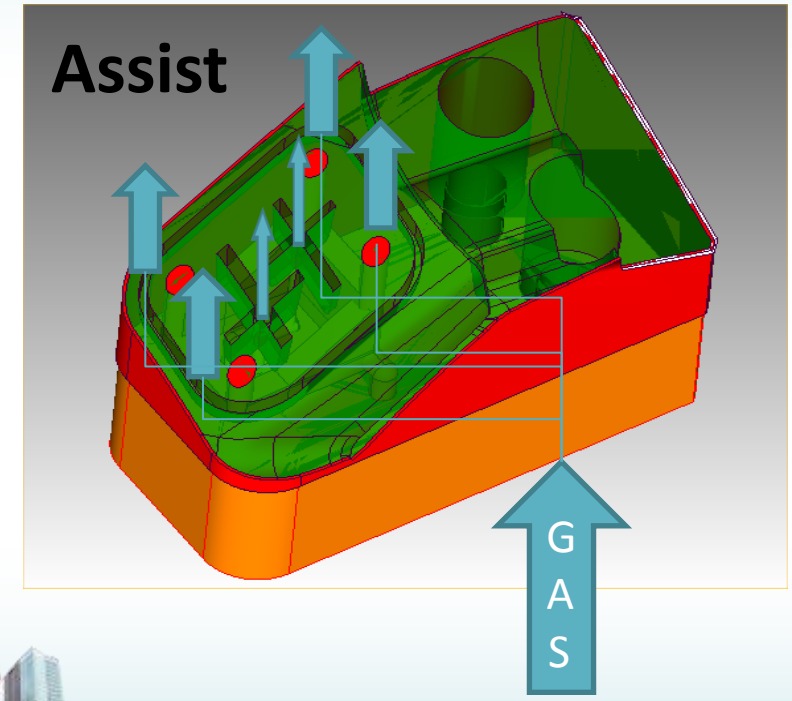


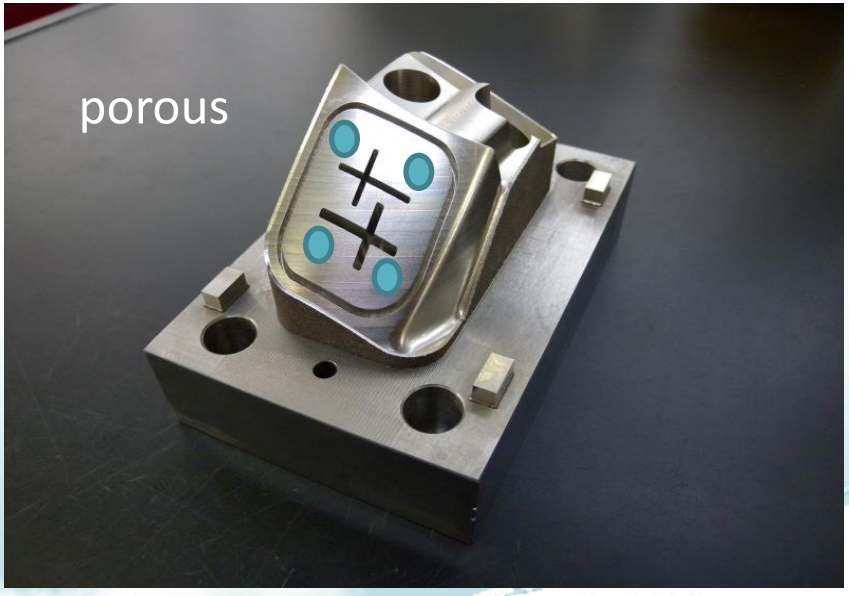




Case example of gas injection core

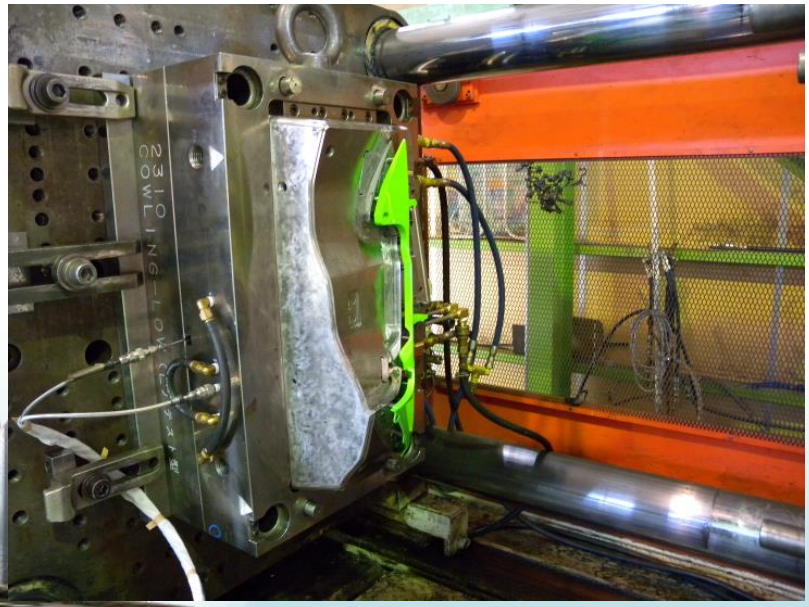
(material : YAG Hrc52)

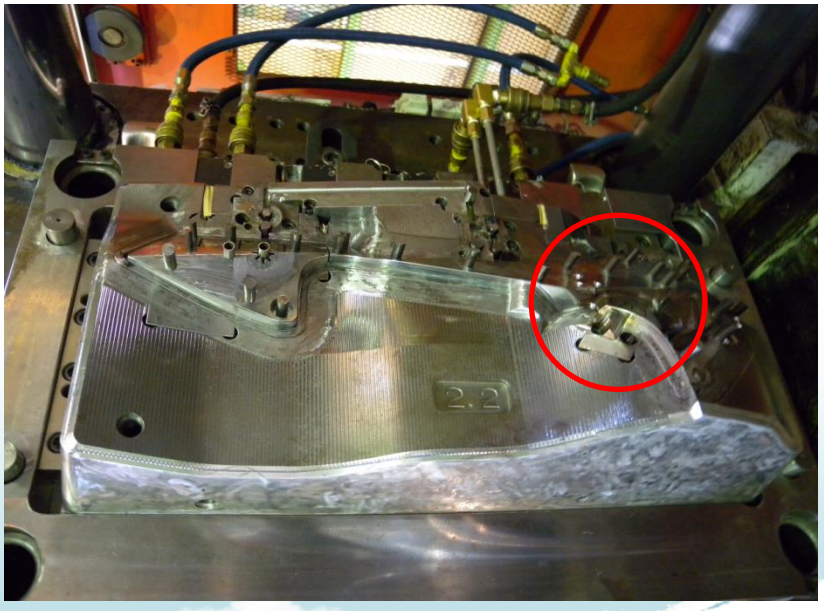




Case example of gas injection core

(material : YAG Hrc52)





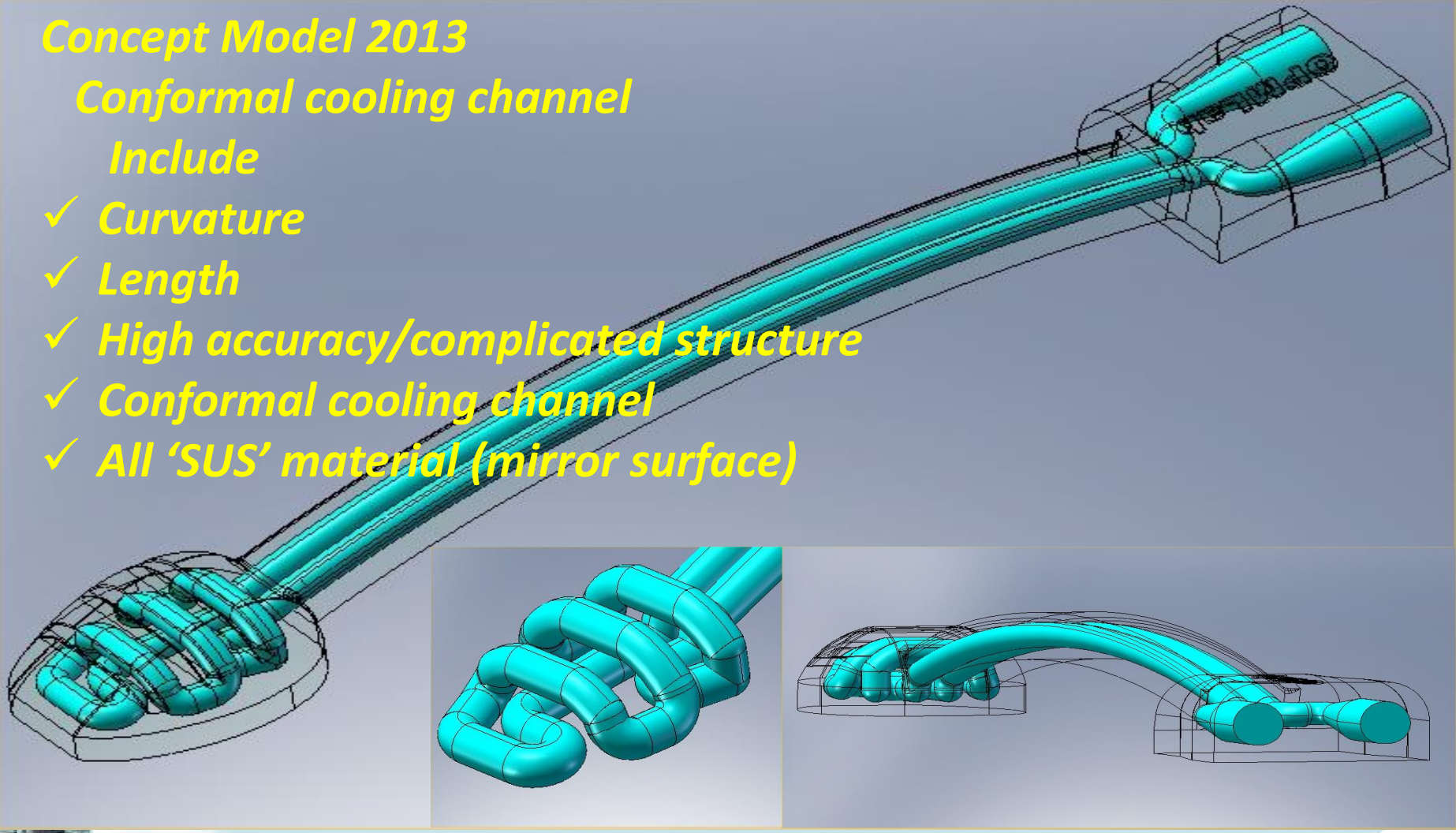
Tip top information

Concept Model 2013

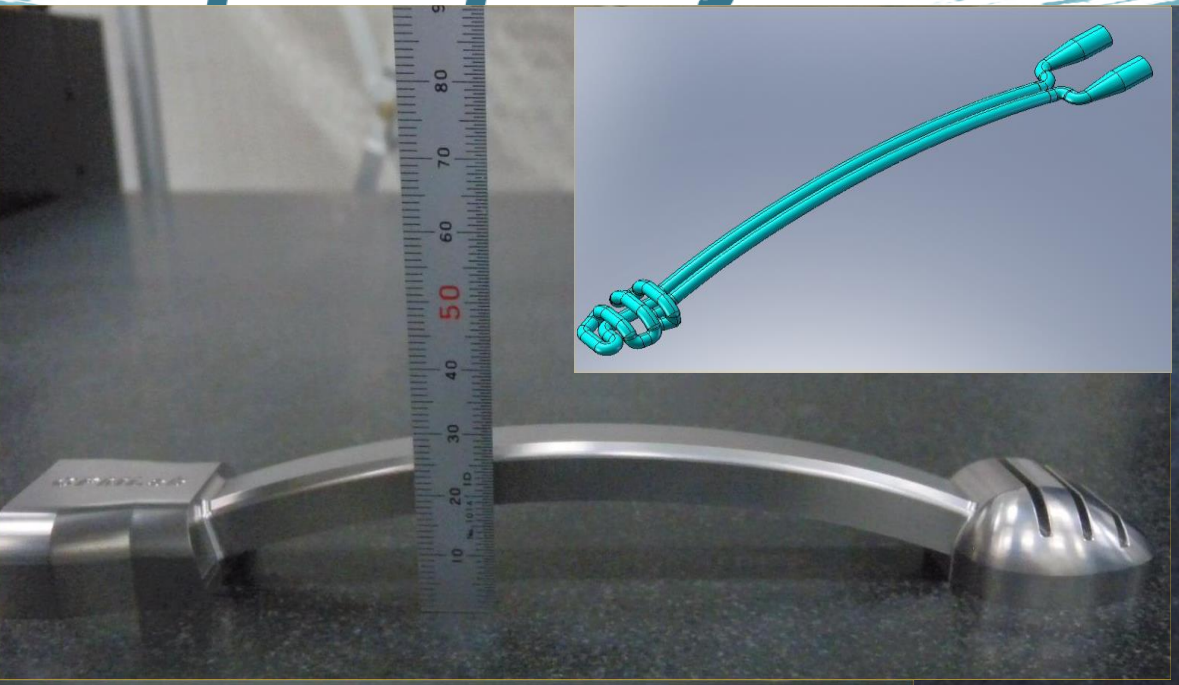
Conformal cooling channel

Include

- ✓ *Curvature*
- ✓ *Length*
- ✓ *High accuracy/complicated structure*
- ✓ *Conformal cooling channel*
- ✓ *All 'SUS' material (mirror surface)*



Tip top information



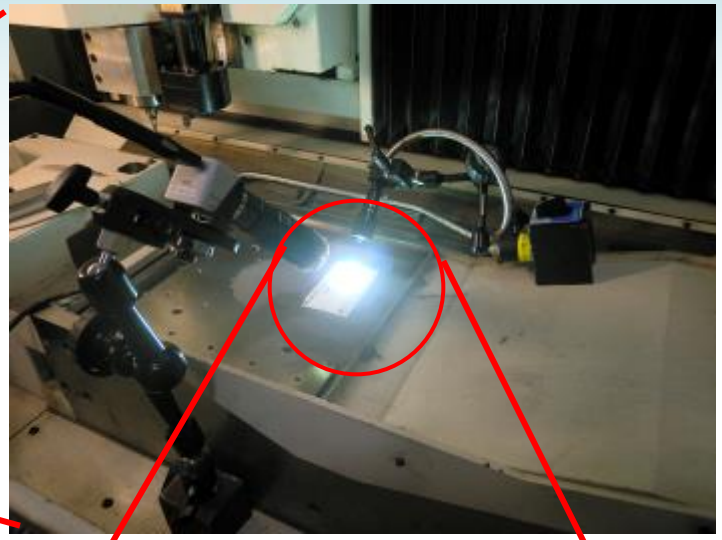
Our technology
(Wide variety of material powders)

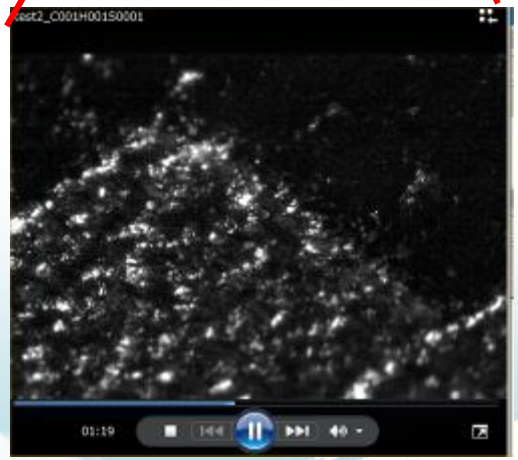
MATERIAL		TENSILE STRENGTH (MPa)	ELASTICITY(%)	0.2% YIELD STRESS (MPa)	YOUNGS MODULUS (GPa)	VICKERS HARDNESS HV	ROCKWELL HARDNESS HRC
OPM-SUS420	Sintered	740	24.7	-	200	-	52～56
OPM-YAG	Sintered	981（2010）	18(11）	686（1910）	-	-	34(52)
OPM-Theta	Sintered						52～54
SUS316L	Sintered	606	32	455	170	200	-
	SOLID	Over 480	Over 40	Over 175	193	200	-
SUS630	Sintered	928	20	650	143	340	34
	SOLID	Over 930	Over 10	Over 725	200	350	35
Co-Cr	Sintered	1025	11	660	194	337	36
	SOLID	Over 655	Over 8	Over 448	200	360	37
Ti-6Al-4V	Sintered	No Data	No Data	No Data	No Data	473	No Data
	SOLID	980	14	921	120	375	38
Ti-6Al-7Nb	Sintered	718	3	585	114	440	45
	SOLID	950	5	890	123	320	32
CRM	Sintered	644	26	490	115	191	-

We can provide adequate materials to satisfy you.

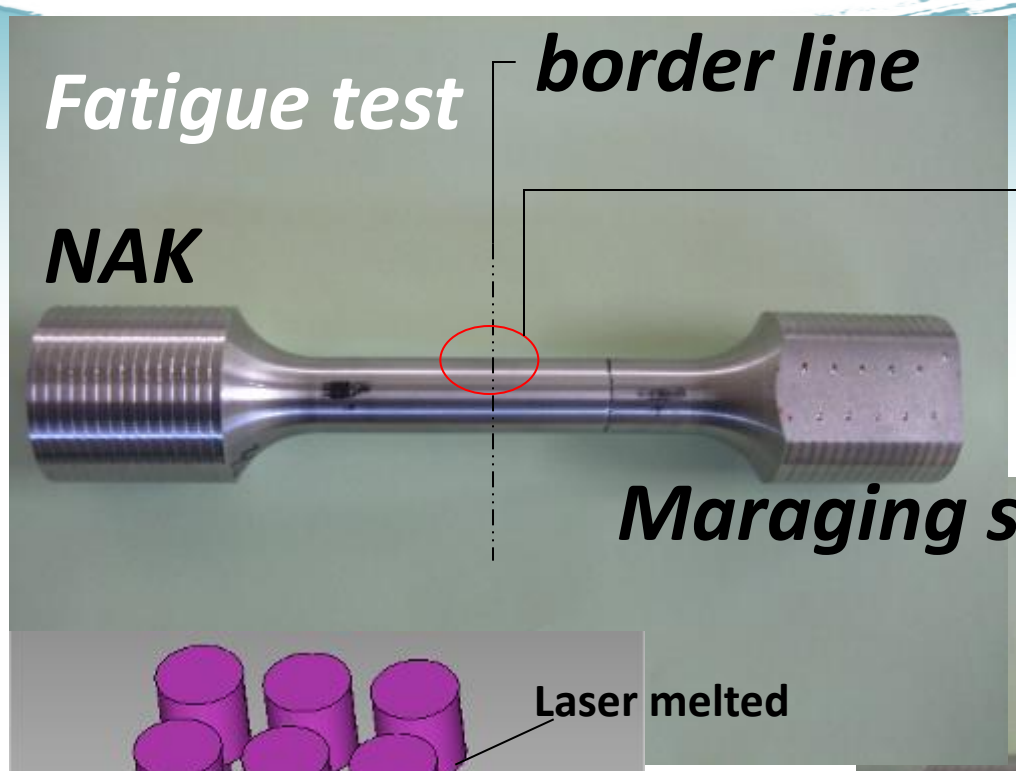
Developing the optimized laser condition for new metal powder through the use of

“ high speed camera”

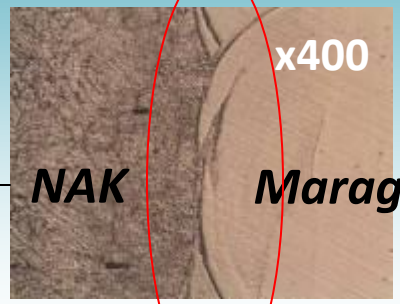


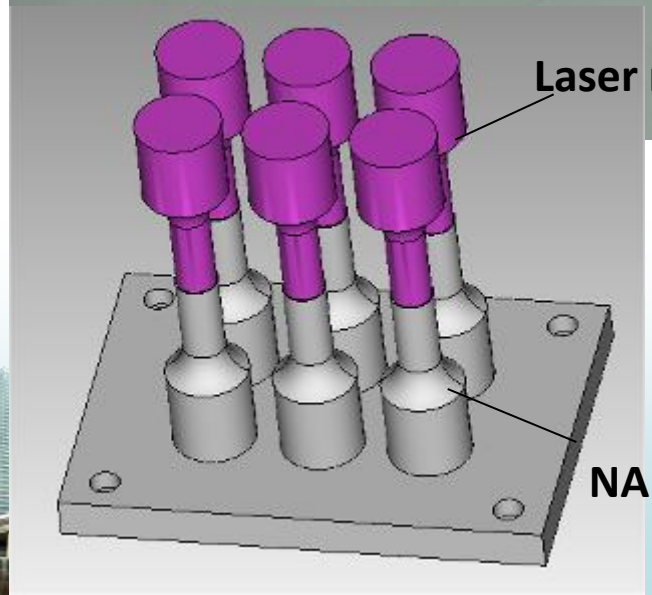


OPM-YAG Fatigue specimen of maraging steel

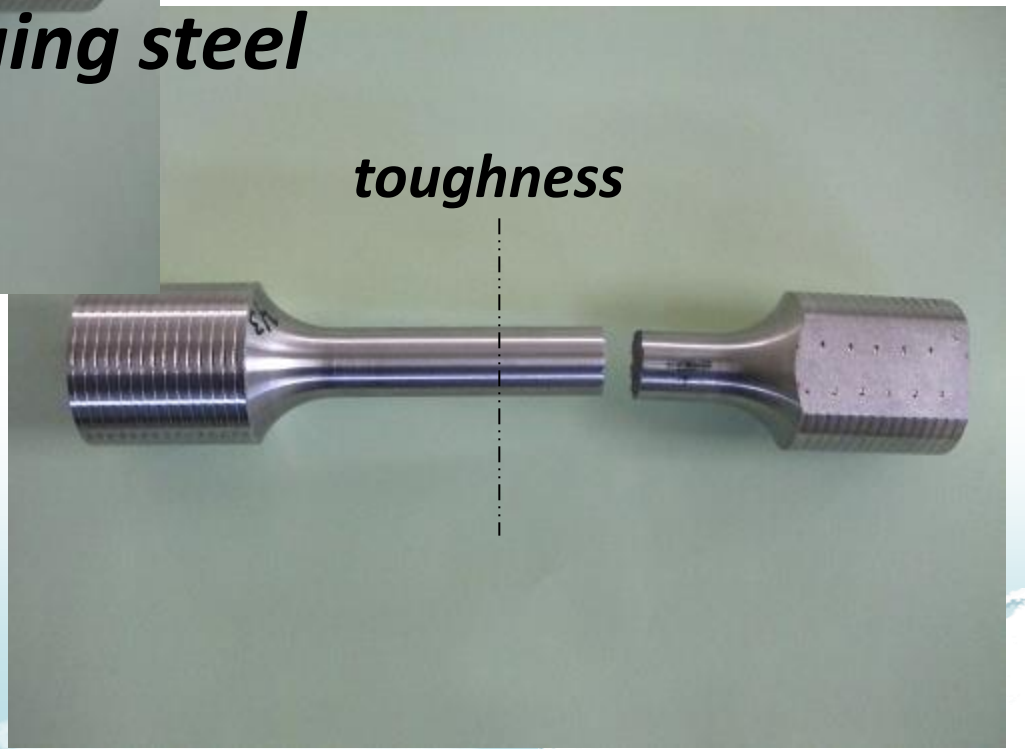


laser surface alloyed

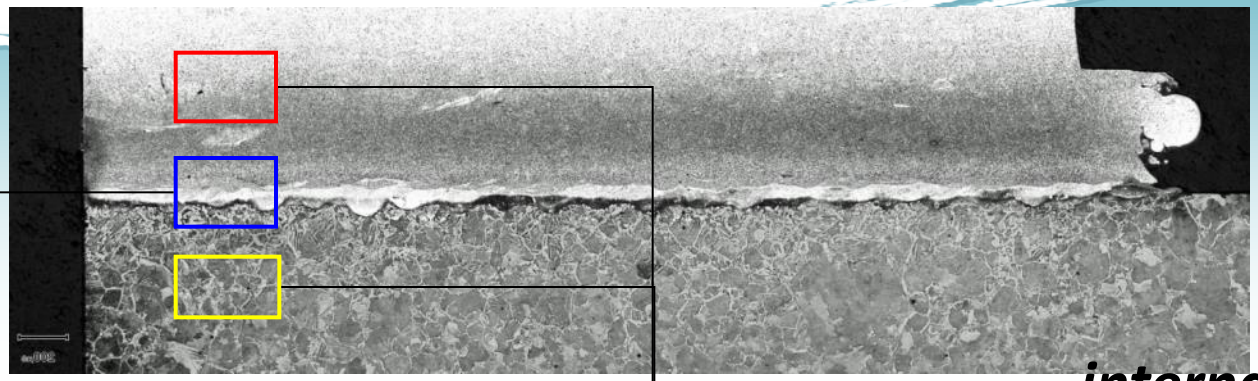




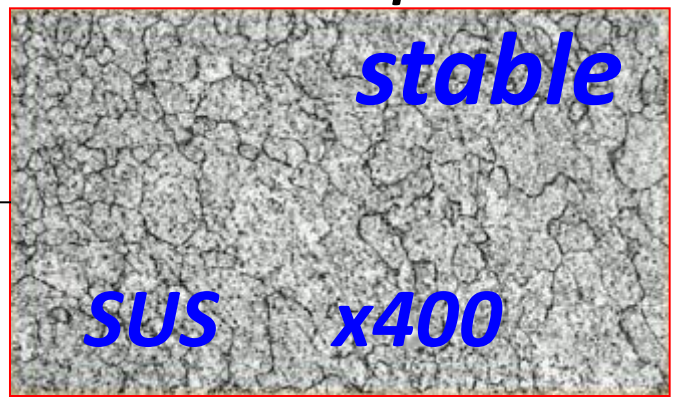
toughness



OPM-SUS After heat treatment



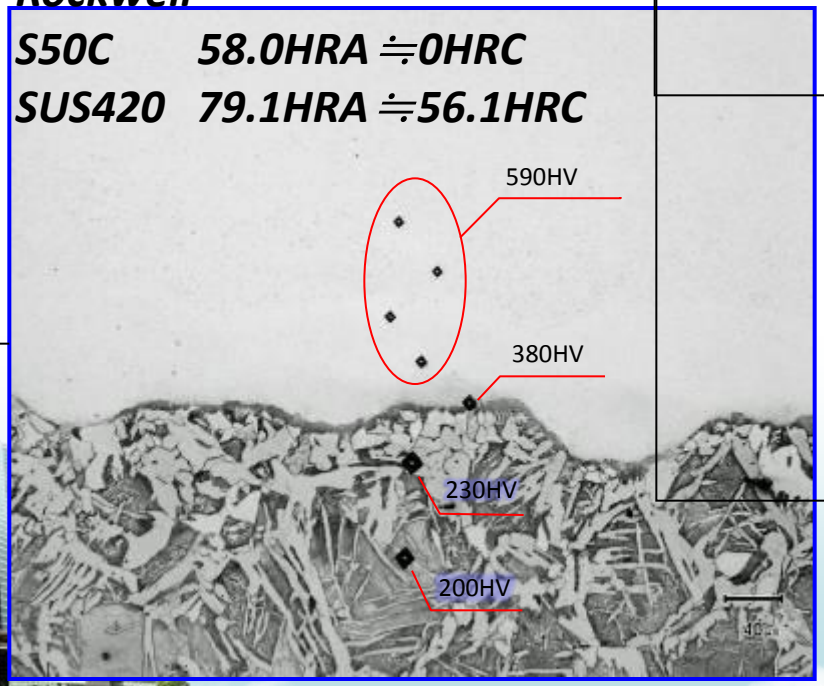
internal composition



Rockwell

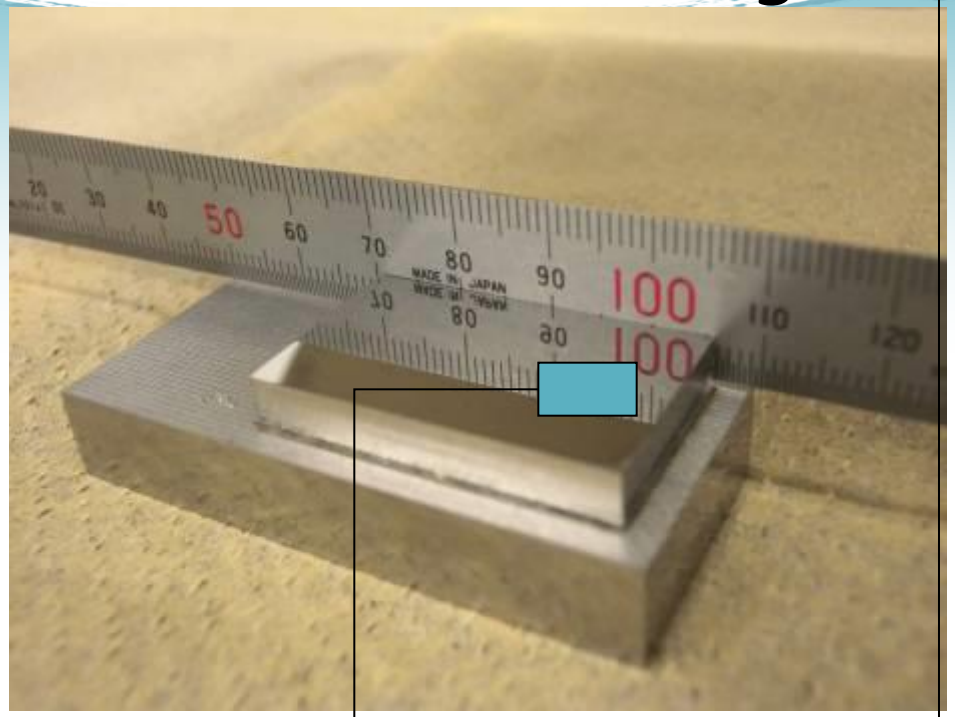
S50C 58.0HRA ≒0HRC

SUS420 79.1HRA ≒56.1HRC



Relative-specular glossiness

OPM-SUS whole average



1.4mm

Digitalization x 15 times

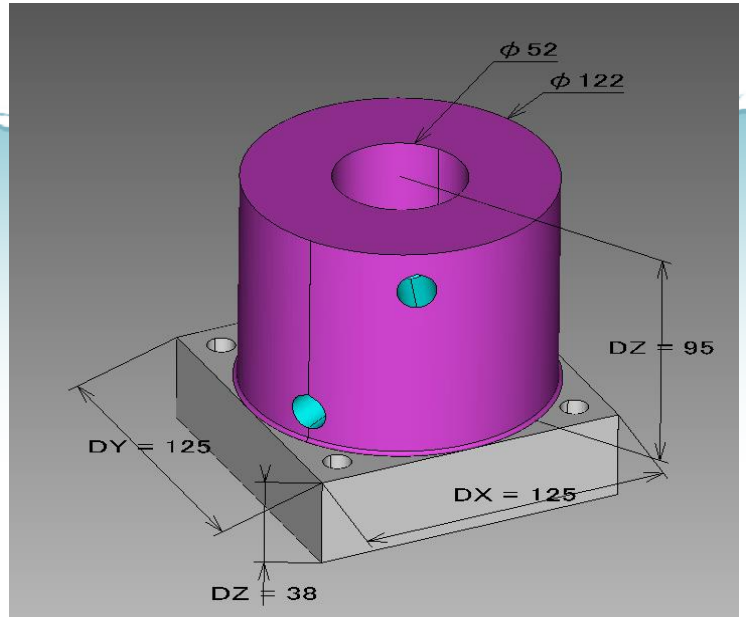
1.38mm

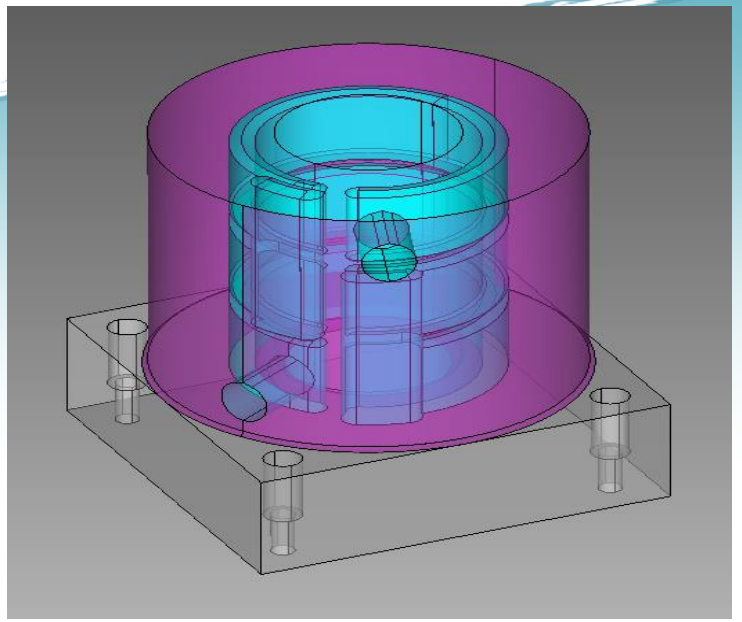
	Phase1: 33 - 68	mesure result
	μm2（whole area）	%
1	1146.93	0.05
2	817.26	0.03
3	338.00	0.01
4	680.99	0.03
5	547.49	0.02
6	617.01	0.03
7	514.95	0.02
8	307.49	0.01
9	1313.16	0.06
10	869.95	0.04
11	1420.22	0.06
12	660.09	0.03
13	1009.18	0.04
14	376.46	0.02
15	712.97	0.03
Whole average		0.03

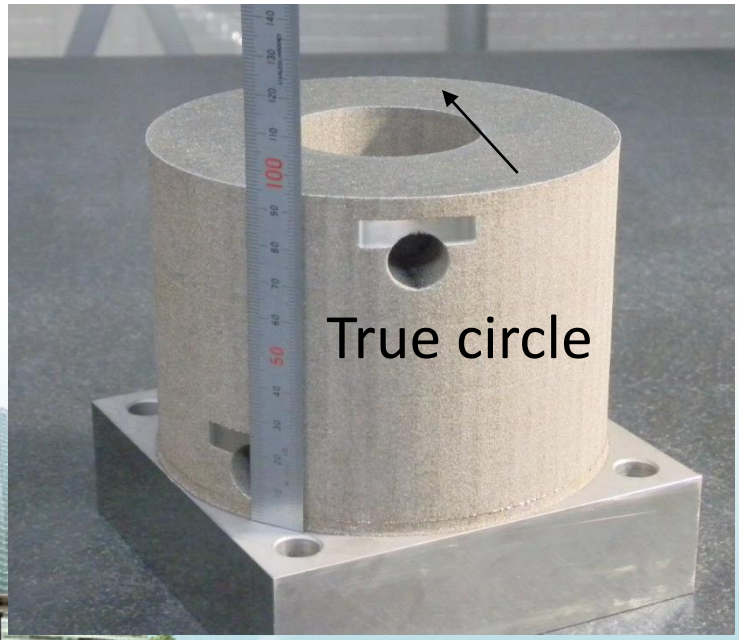
Melting average

99.97%

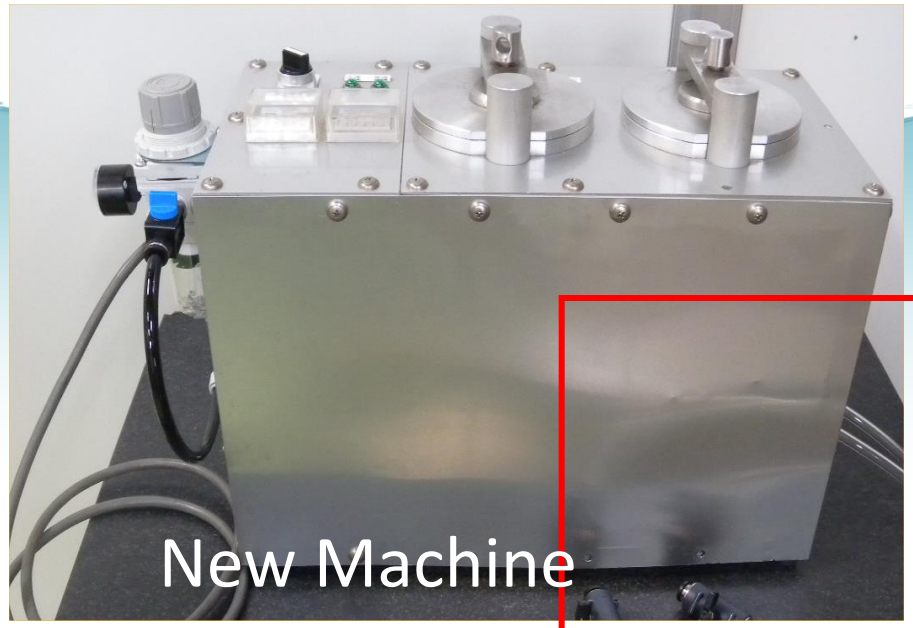
Extra-large volume sintered of OPM-SUS

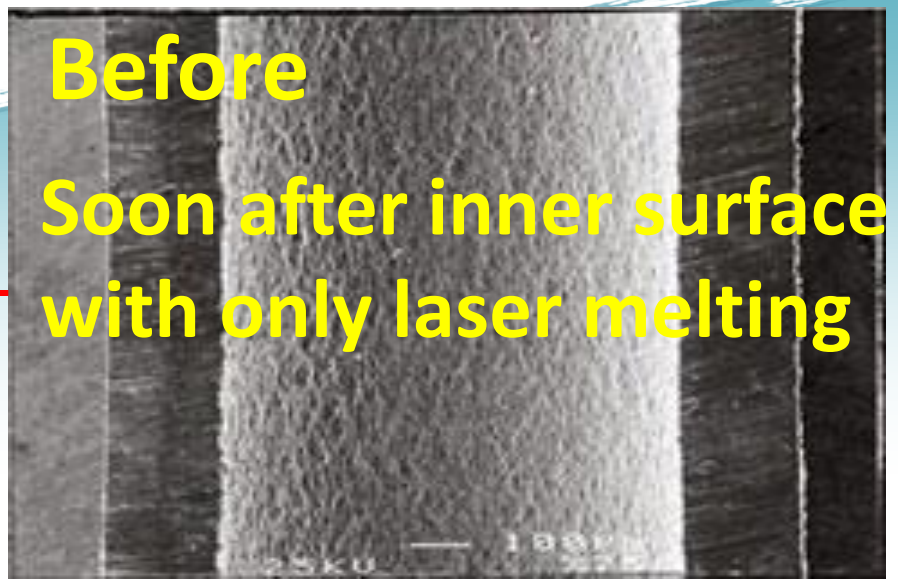


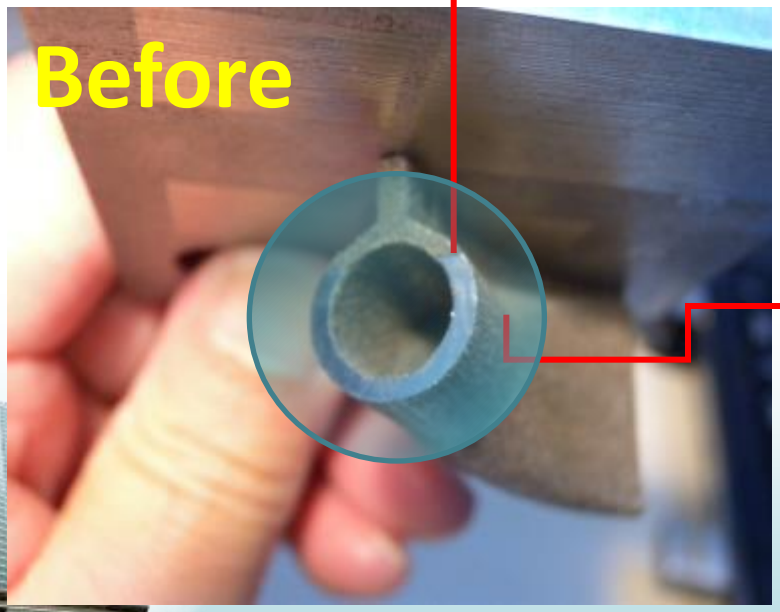




Improving the inner surface of a cooling channel

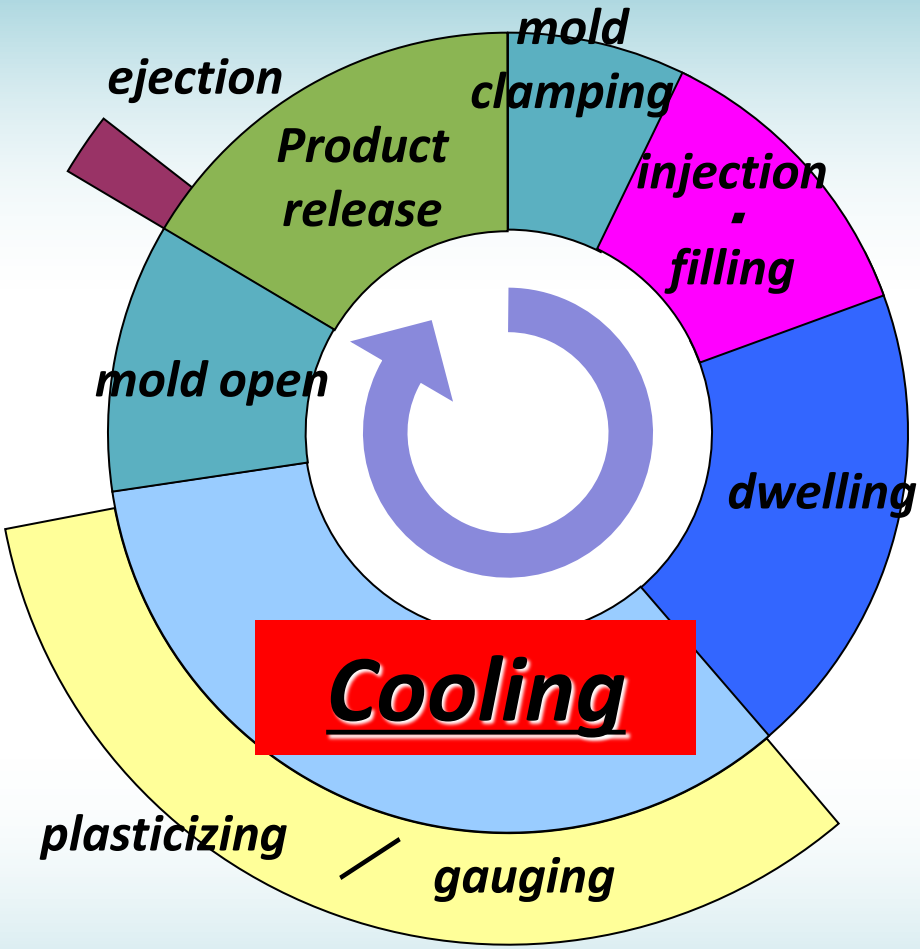






Issue of the plastic injection molding

Time is money.



Molding process

Case1 of Molding

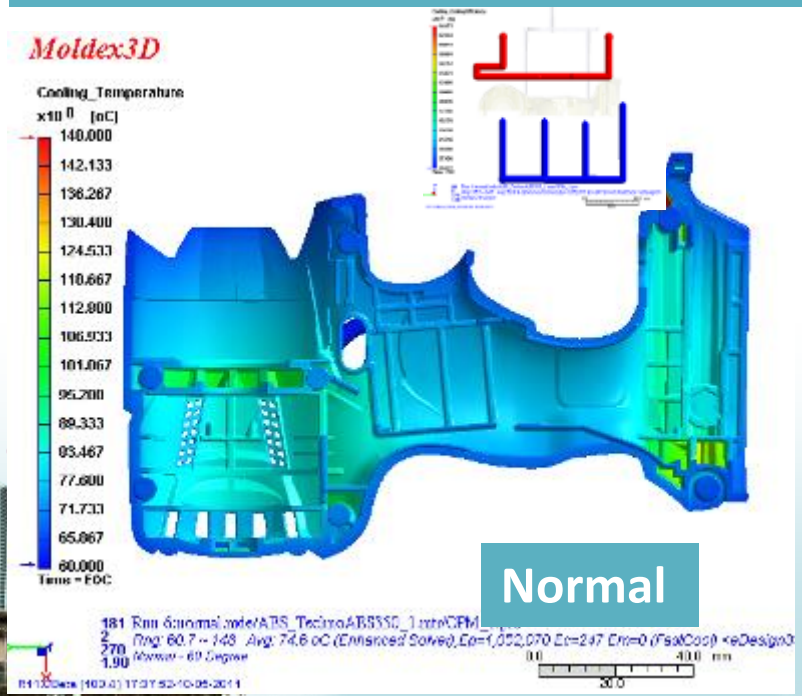
Feed back

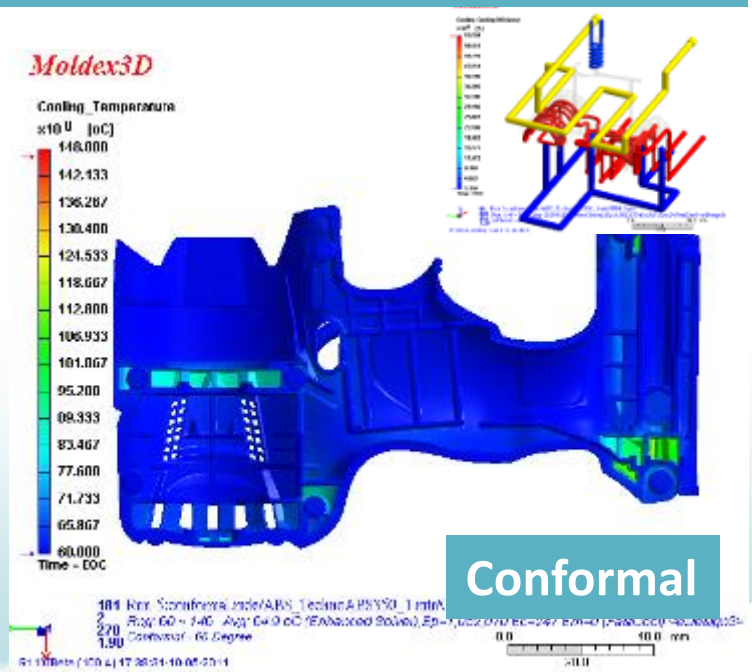
Mold design → Conformal Cooling Design → CAE Thermal Prediction of cycle time Resin flow → Production → Injection

Optimize

Make the impossible possible by OPM technology

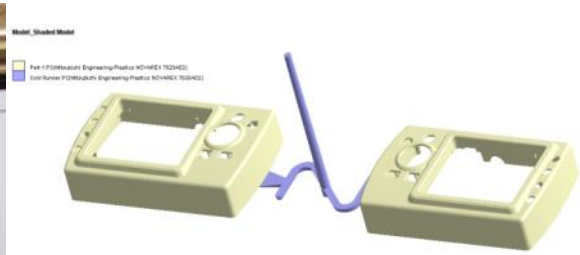
Optimized ability of heat exchange for tooling

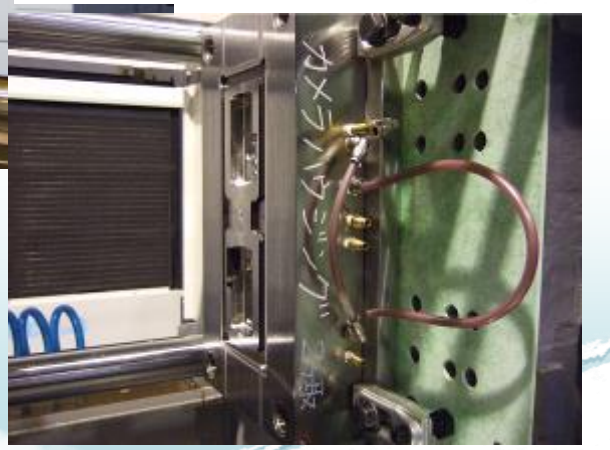




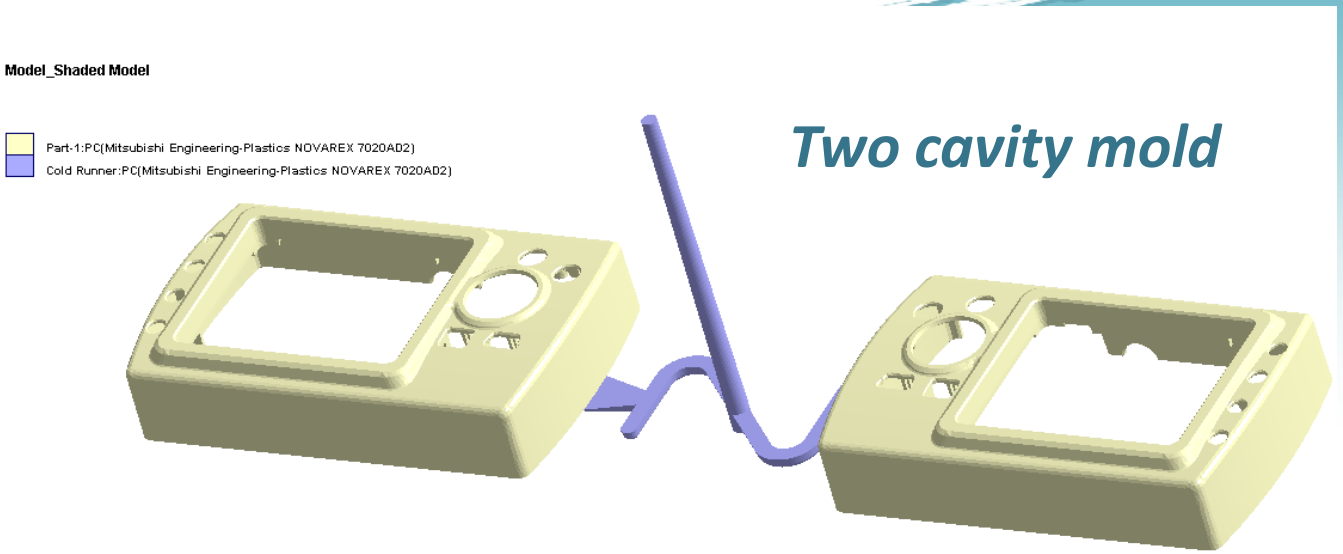
Case2 of Molding for precision

Parameter		Condition
Temperature	CAV	50℃
	COR	50℃
	Sprue	Water passage
Target	Target cycle	22s（cooling 10s）





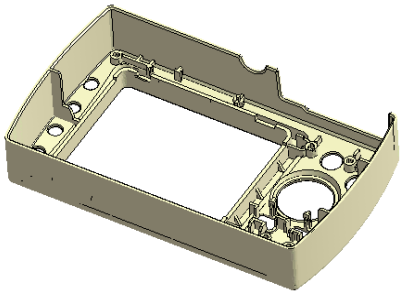
Case2 of Molding



Two cavity mold

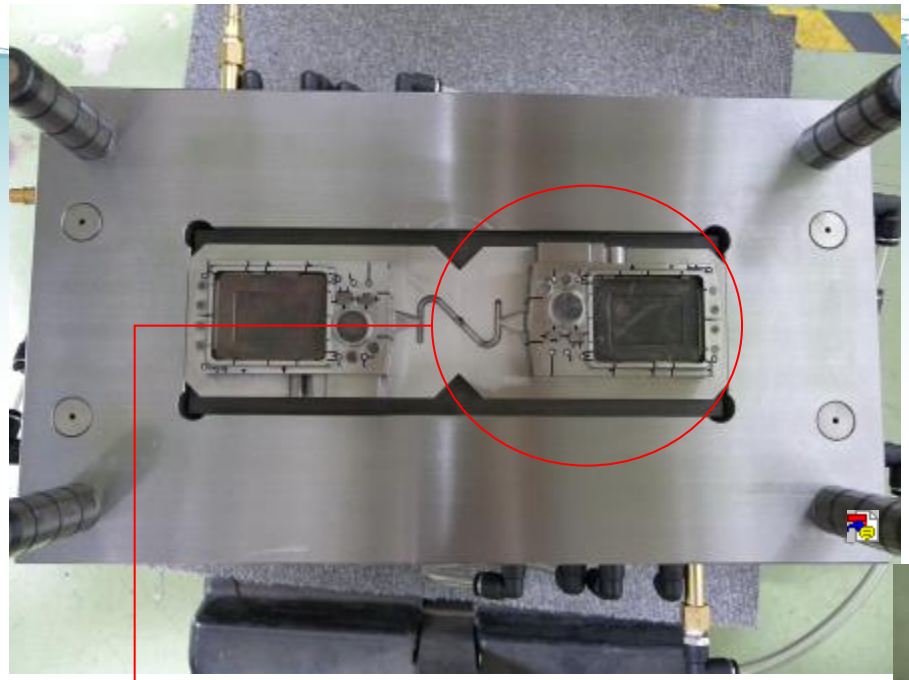
- *Length ：270mm*
- *Height ：21.5mm*
- *Width ： 60mm*
- *Thickness ： 1.2mm*

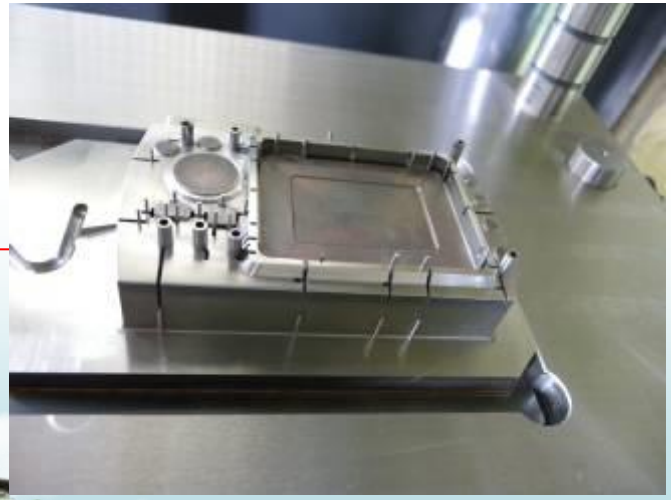
Front

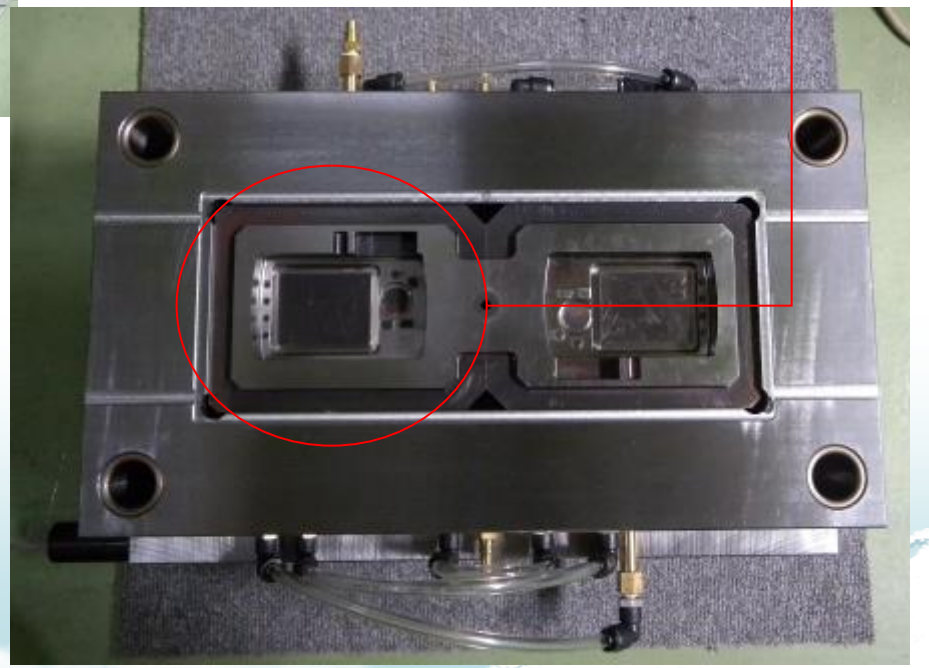


Back

Case2 of Molding

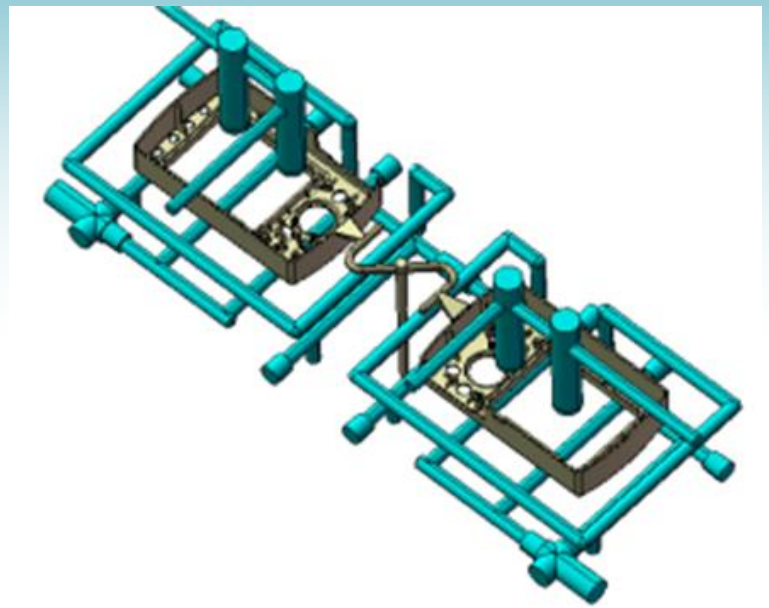






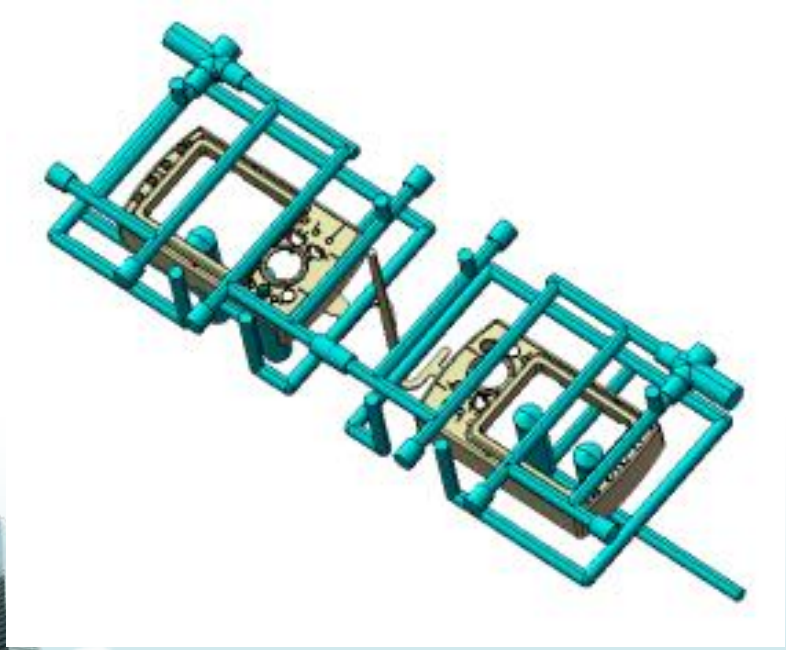
Case2 of Molding

Normal cooling design



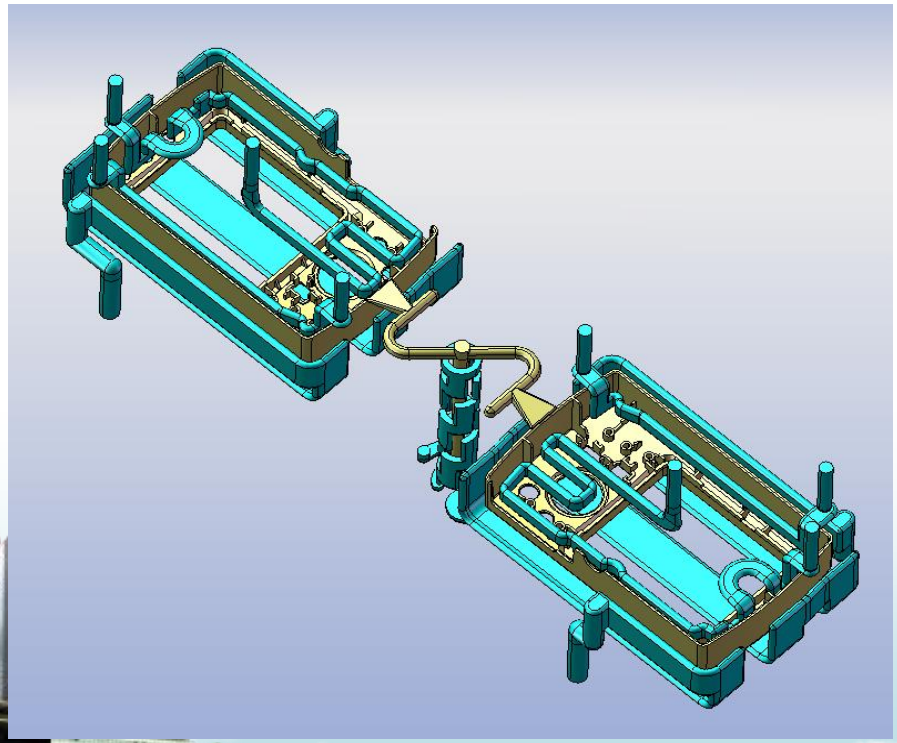
Core side

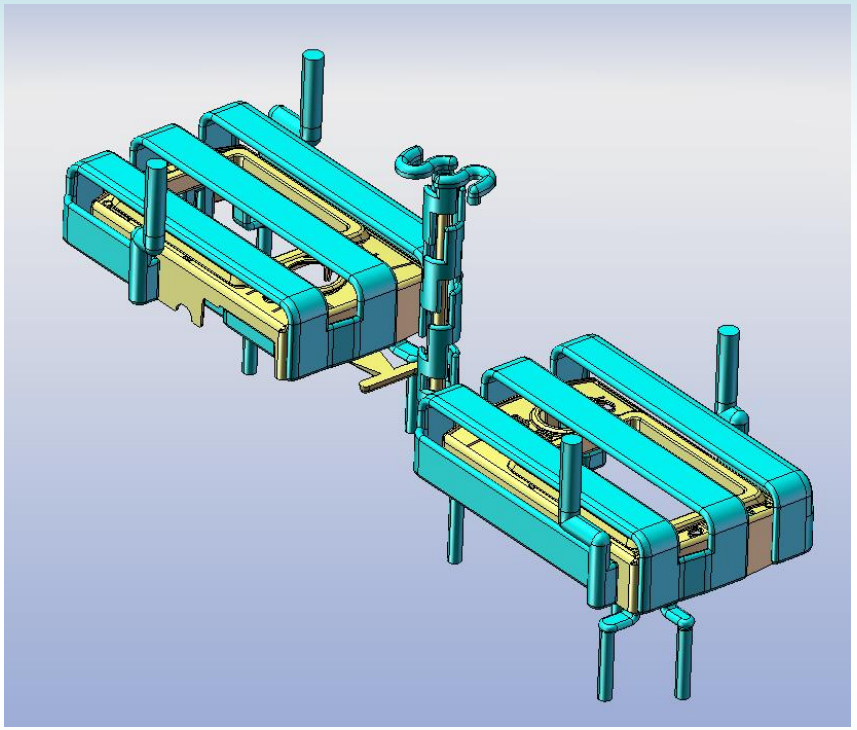
Cavity side



Case2 of Molding
Conformal cooling design

Core side

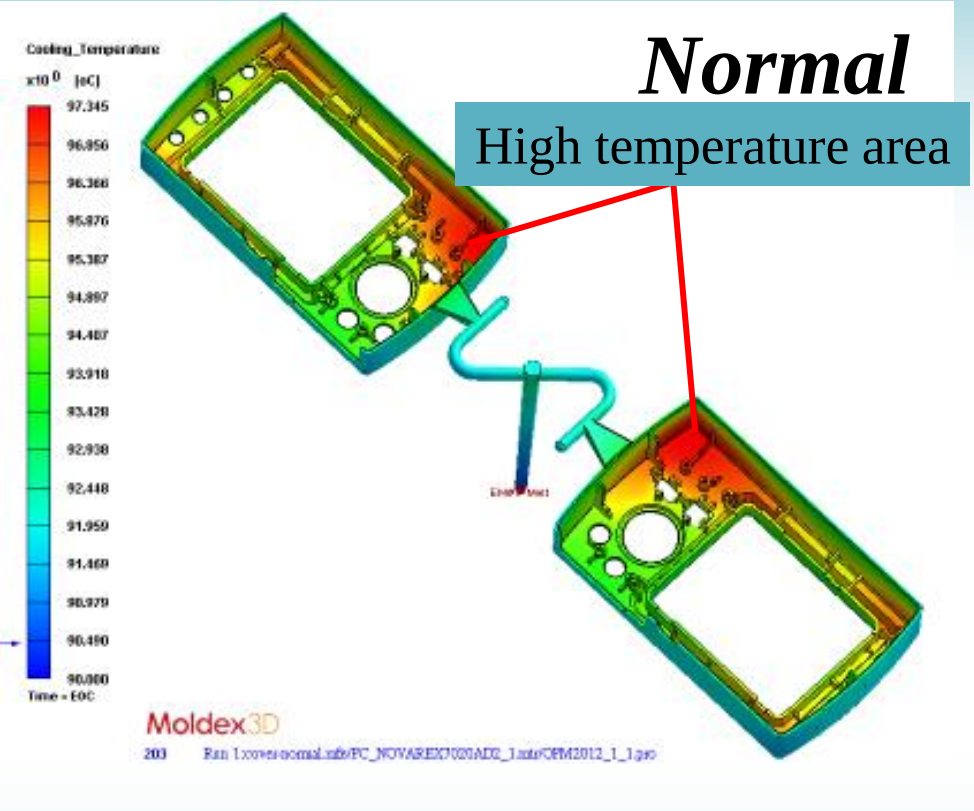




Cavity side

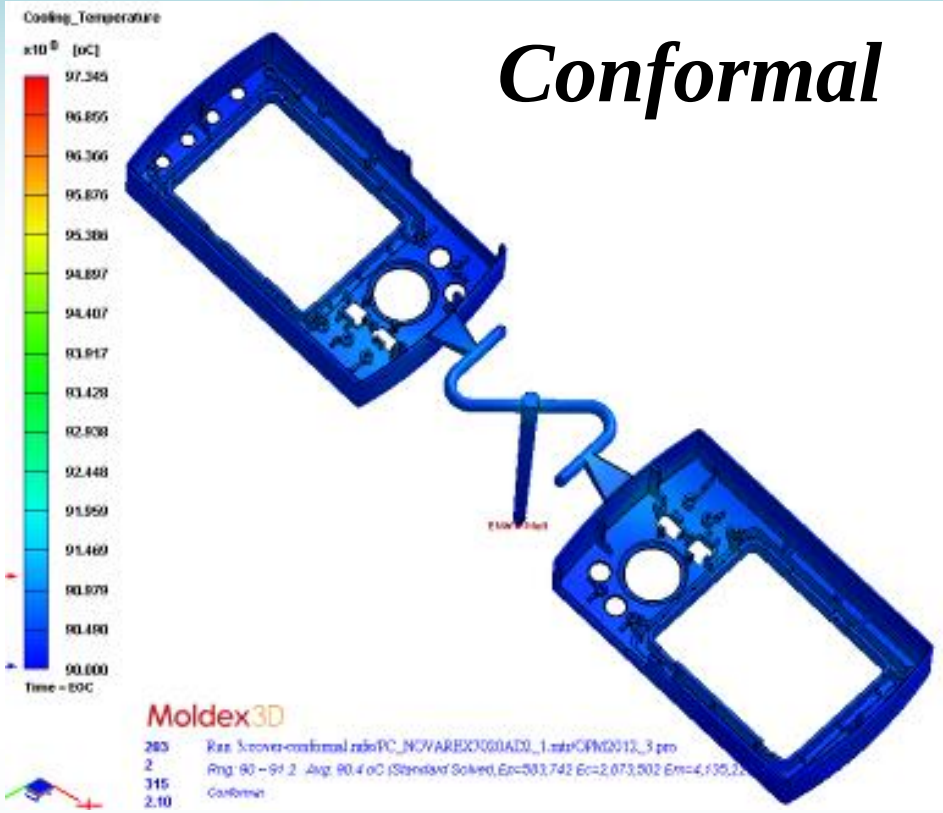
Case2 of Molding

Range set at: 90~97 ℃



Normal

High temperature area

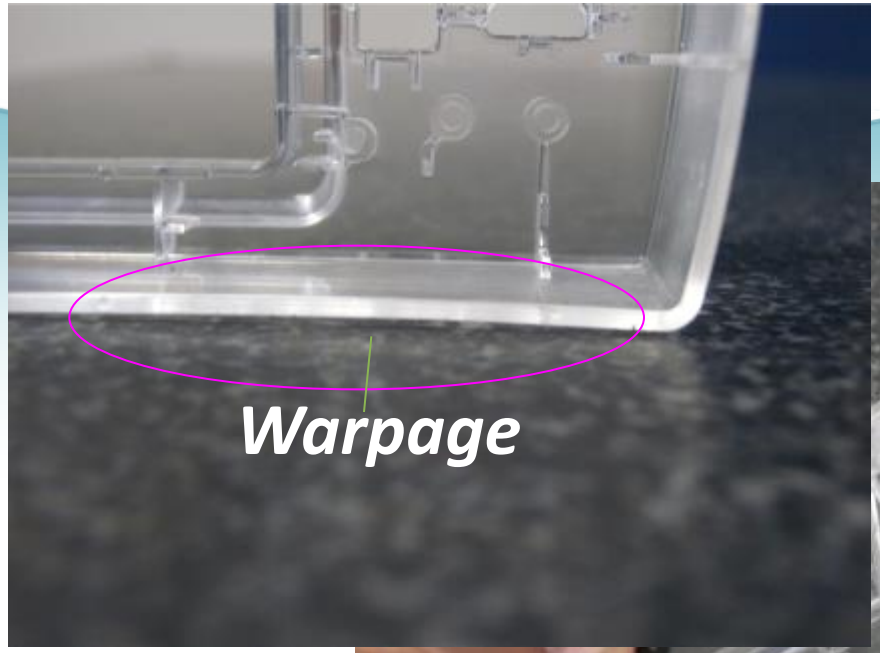


Conformal

Normal range:
90.9 – 95.4 ℃

Conformal range:
90-91 ℃

Normal



Cooling time:13 s

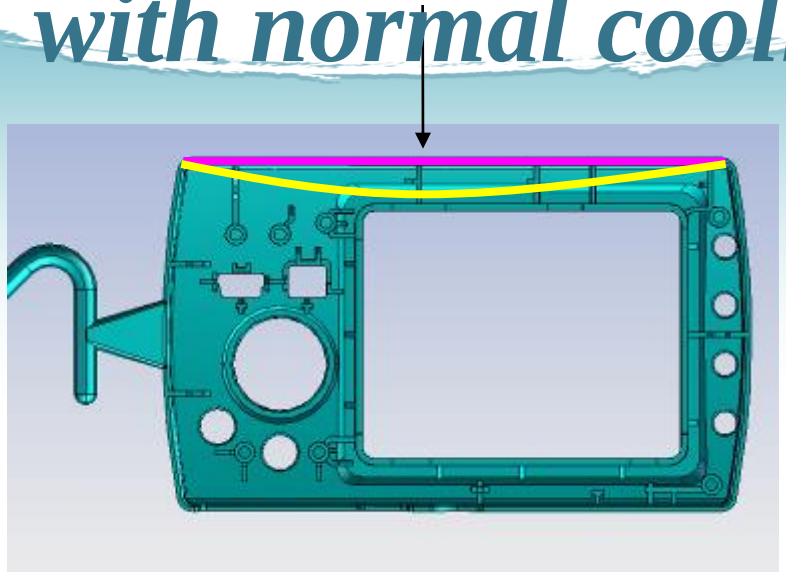
Molding cycle :25s

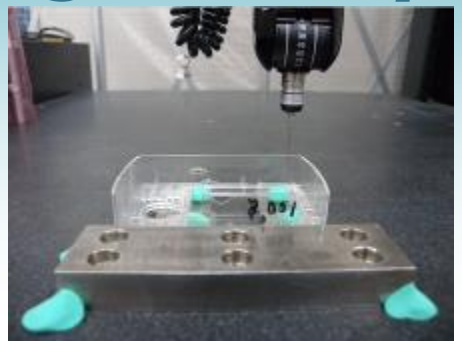
Conformal

Cooling time:9 s

Molding cycle :21s

Compare amount of warpage with normal cooling to conformal one

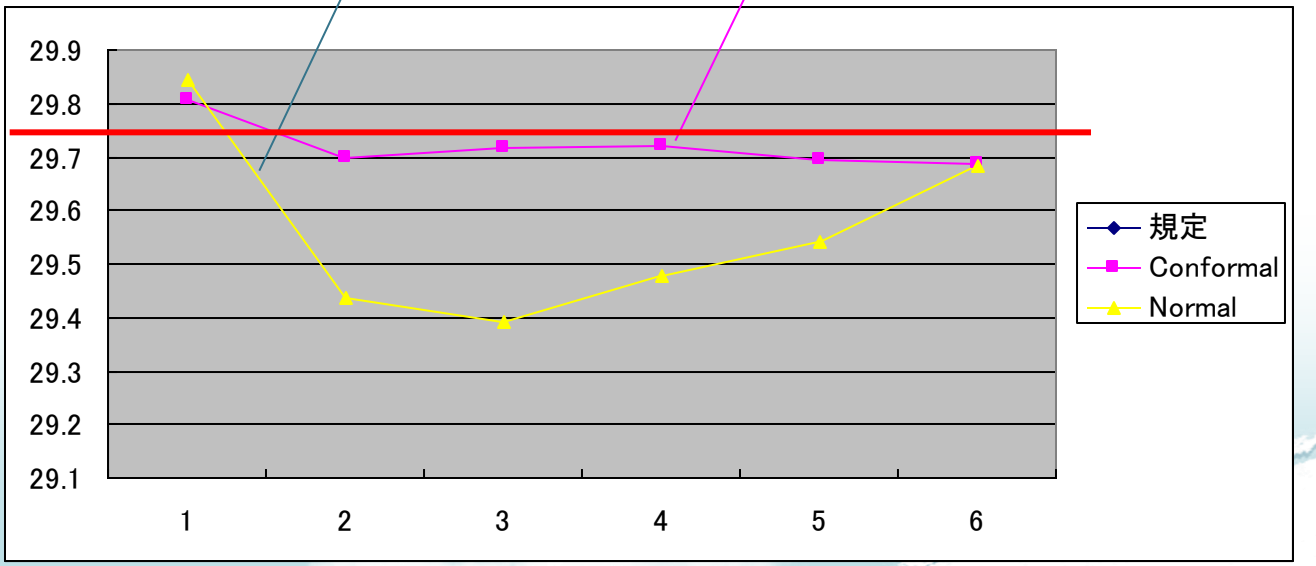




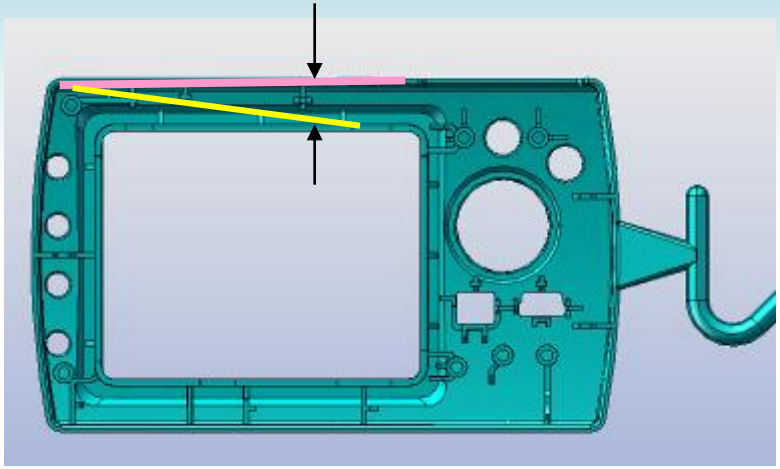
Normal

Conformal

Designed value



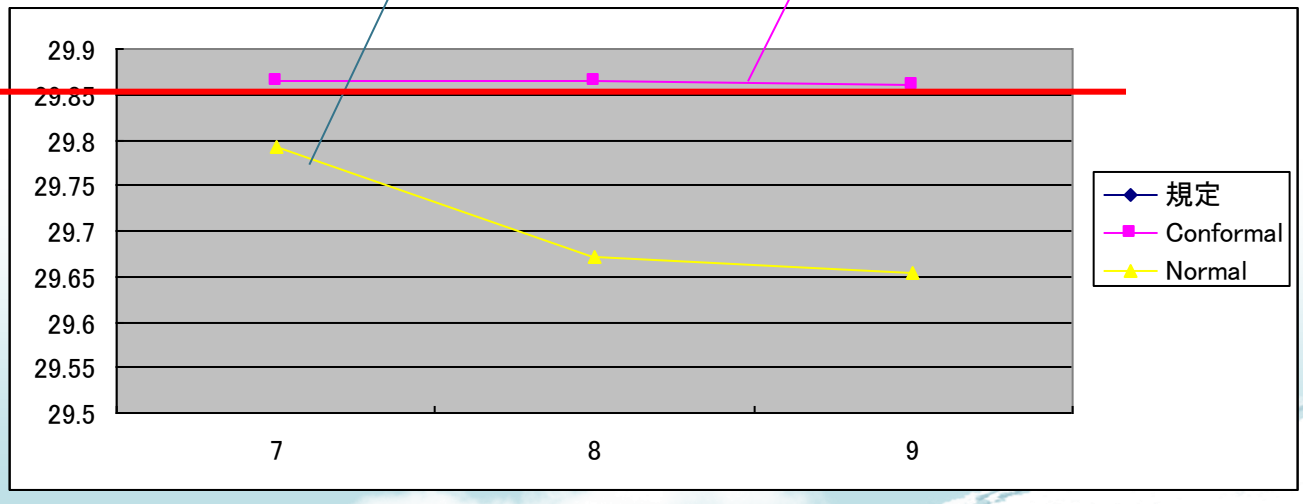
Compare amount of warpage with normal cooling to conformal one



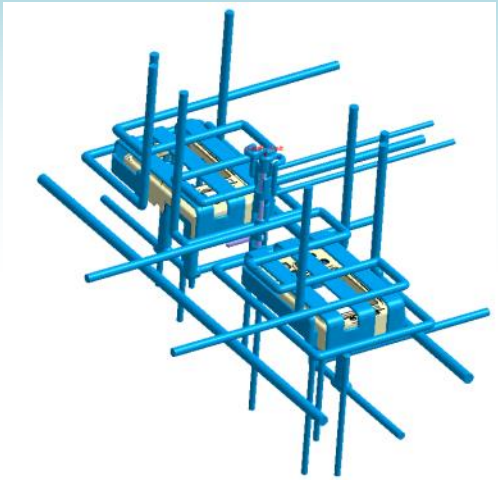
Normal

Conformal

Designed value



The Cooling time can be shortened more than 30%.



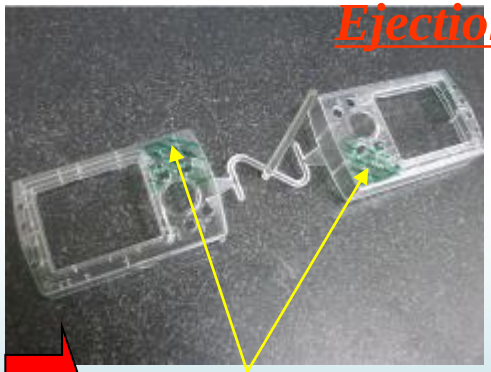
Conformal

Cooling time:9 s
Molding cycle :21s

Applicable to continuous molding

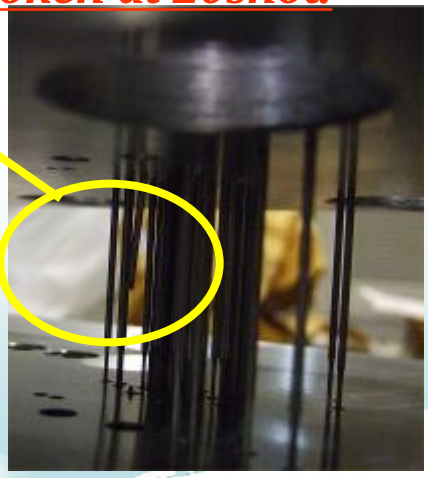
Normal

Cooling time:13 s
Molding cycle :25s
However ……..
to Next page.



Shrink mark

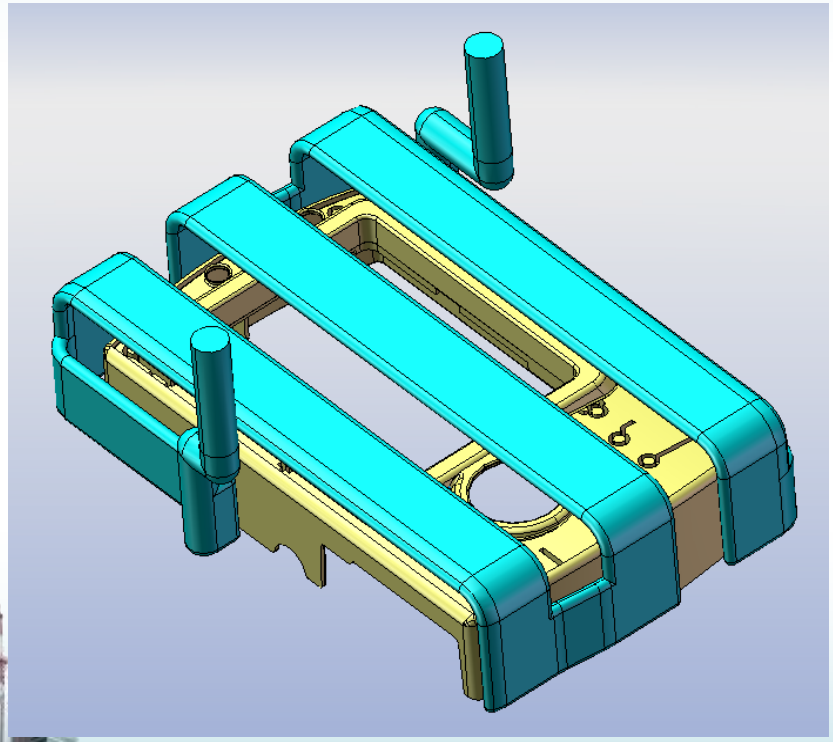
Ejection pin was broken at 20shot.

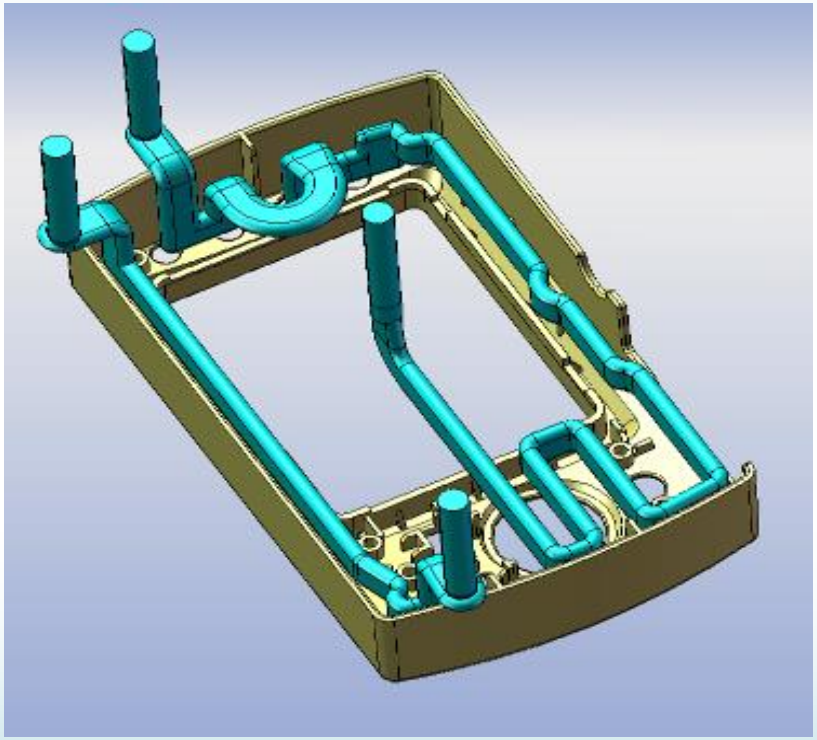


Inapplicable to molding

Case2 of molding Conclusion

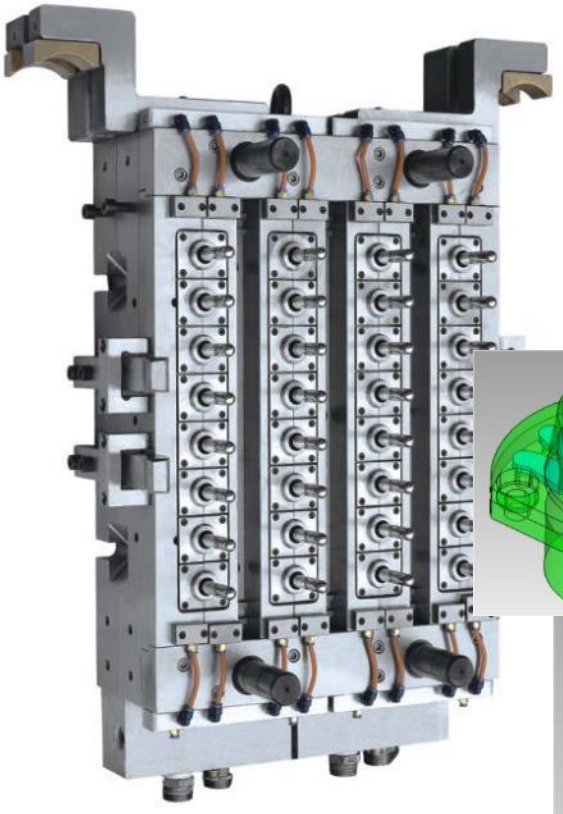
Conformal cooling channel along the lines with the wall of products prevents the warpage.
At the same time , we achieved the reduction of cooling time by 30%.
And Conformal cooling technology makes the continuous molding more stable one.

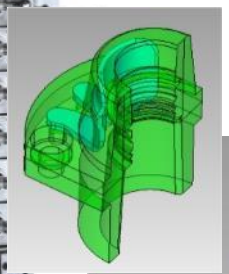


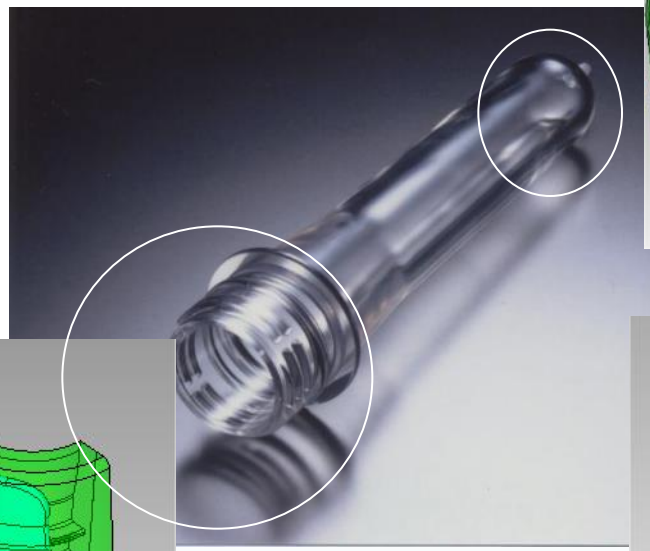


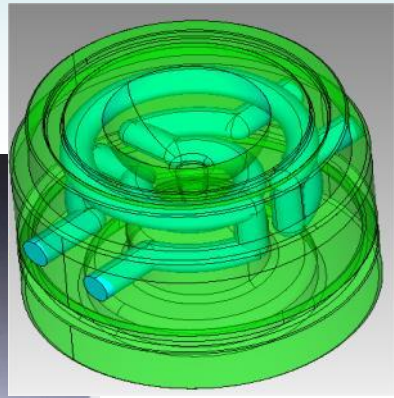
For your just information

We can provide the pre-form parts with SUS
‘’ the parts with conformal cooling channel’’
through the use of OPM technology.

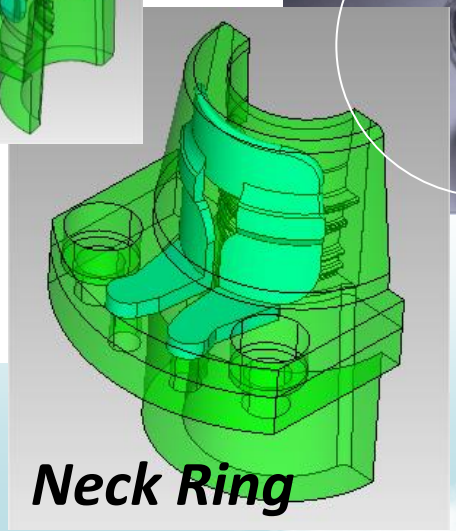




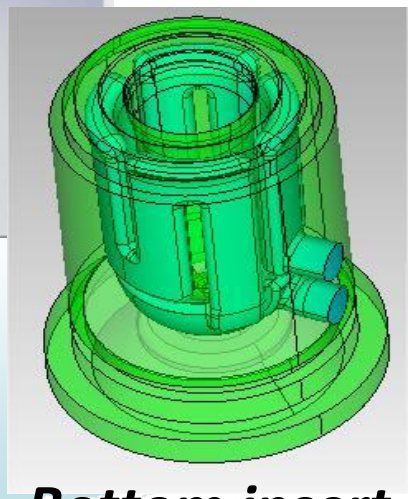




Bottom insert



Neck Ring



Bottom insert

Greemolding
Association of Solutions

OPM lab
OPM laboratory Co.,Ltd.

RISE MOLD
LASER TECHNOLOGY

Thank you for your attention!

OPM lab
OPM laboratory Co.,Ltd.