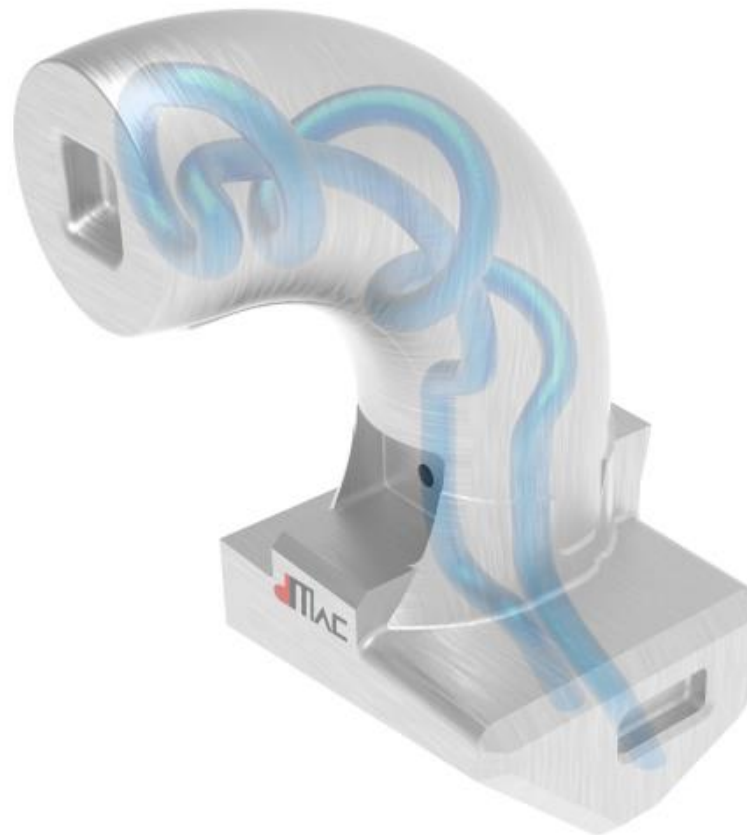
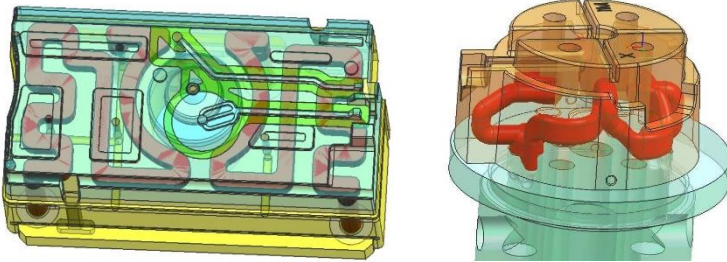


## ADDITIVE MANUFACTURING INSERTS



## Characteristics of 3D printing insert



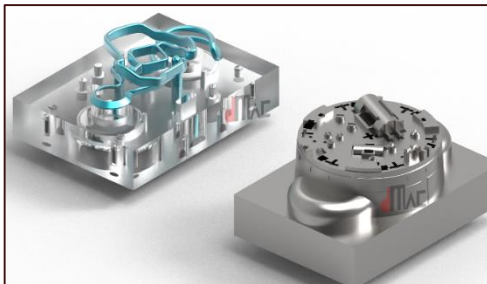
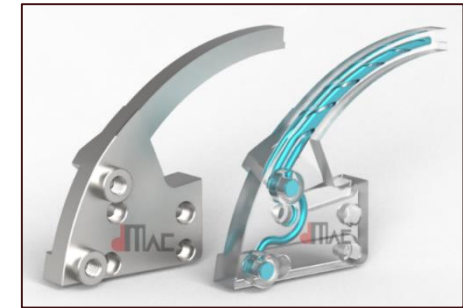
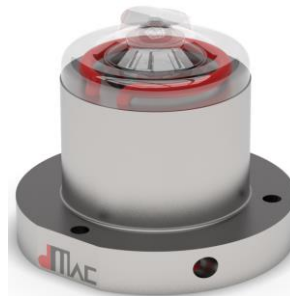
1. There two types of metal powder that are suitable for plastic injection tool : MS1(equivalent to 1.2709 steel) and CX (equivalent to Assab Corrax – stainless steel)
  - MS1 hardness : 52 – 54 HRC (after heat treatment)
  - CX hardness : 48-51 HRC (after heat treatment)
2. After printing, the insert hardness is about 30 – 34 HRC(before heat treatment)

3. After printing, insert surface roughness:-

- MS1 = Ra 9um / Rz 50um
- CX = Ra 5um / Rz 26um

4. AM insert can be polish up to SPI A-3 to A-2 level

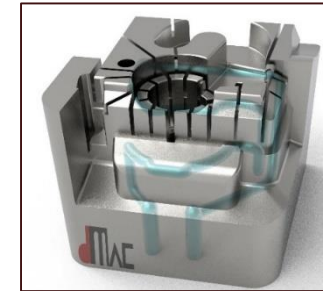
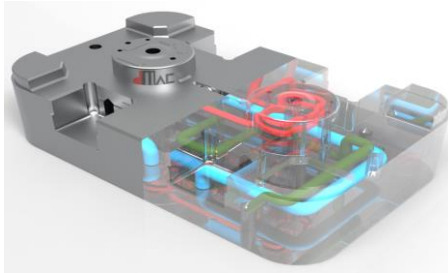
5. AM insert can be laser weld



6. AM insert can be texture or laser texturing
7. AM insert can be coated
  - It is recommended to use a coating process temperature not more than 400 degree
  - Recommendation coating process : nickel and PVD

## Advantages of AM for the tool making

- ◆ **Freedom of design**
- ◆ **Hot spots or critical areas** of the insert is able to implement conformal cooling system
- ◆ **Productivity** increased due to cycle-time reduction and better molding yield rate



- **Part quality** improved due to better cooling system through conformal cooling
  - Better dimension stability
  - Less deformation on the product
- **High number of various cooling designs** are possible

- ◆ **Reduction of cost** per plastic product
- ◆ Validation of benefits and results through **simulation**
  - Flowrate analysis
  - Identified hot-spot areas
- ◆ **Insert life time** improved due to better uniform cooling system – conformal cooling



# Type of material For 3D Printing

# 3D printing steel vs conventional steel

	Conventional Steel Material			3D Printing Steel Material	
	Orvar Supreme (1.2344)	Stavax (1.2083)	1.2343 (H13)	1.2709 (MS1)	CX (Assab Corrax)
Yield strenght (Rp 0.2%) 【Mpa】	1250	1290	1400	1930	1670
Tensile strenght 【Mpa】	1400	1780	1600	2050	1760
Elongation at break 【%】	13	NA	3-5	4-6	7
Modulus of elasticity 【Gpa】	210	210	215	200	200
Hardness 【HRC】	52-54	48-52	52-54	52-54	48-51
Density 【Kg/dm3】	7.8	7.74	7.8	8.0	7.7
Coefficient of thermal expansion 【m/mK】	$12.6 \times 10^{-6}$	$11 \times 10^{-6}$	$11.3 \times 10^{-6}$	$10.3 \times 10^{-6}$	$11.7 \times 10^{-6}$
Thermal conductivity 【W/m °C】	25	20	25	20	21
Corrosion resistance	Yes	Yes	No	No	Yes

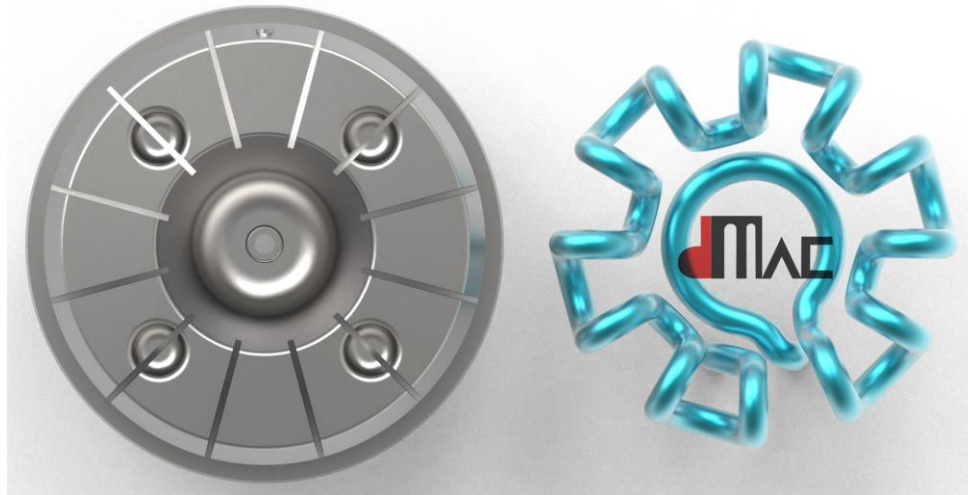


# Difference type of powders for 3D printing

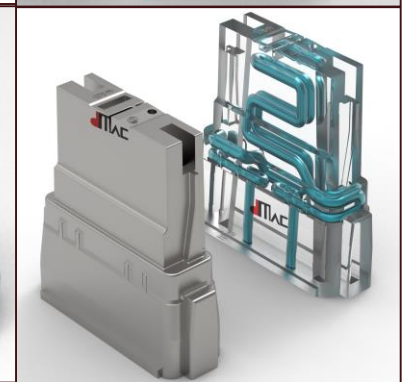
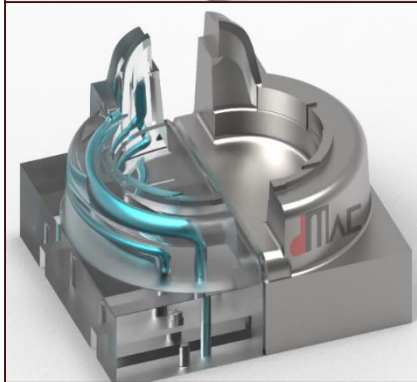
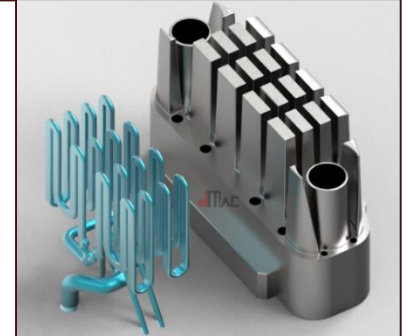
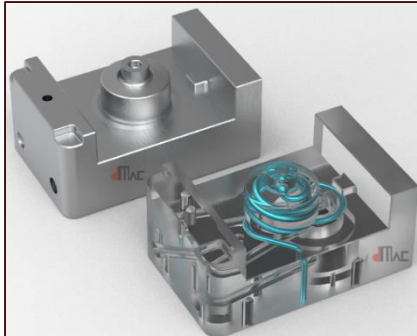
Family	Metal Alloy
Aluminium	EOS Aluminum AlSi10Mg
Cobalt Chrome	EOS CobaltChrome MP1
	EOS CobaltChrome RPD
	EOS CobaltChrome SP2
Maraging Steel	EOS MaragingSteel MS1
Nickel Alloy	EOS NickelAlloy HX
	EOS NickelAlloy IN625
	EOS NickelAlloy IN718
Stainless Steel	EOS StainlessSteel 17-4PH
	EOS StainlessSteel 316L
	EOS StainlessSteel CX
	EOS StainlessSteel GP1
	EOS StainlessSteel PH1
Titanium	EOS Titanium Ti64
	EOS Titanium Ti64ELI
	EOS Titanium TiCP Grade 2



# 3D Printing for Tooling Application



## 3D Printing for Tooling Application-1



**Main  
Insert**

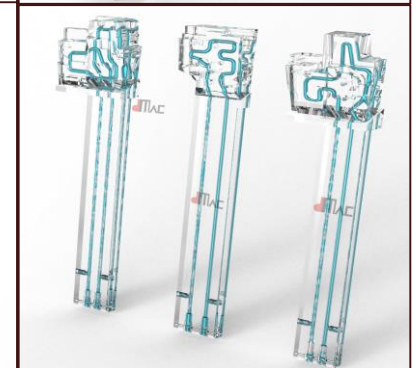
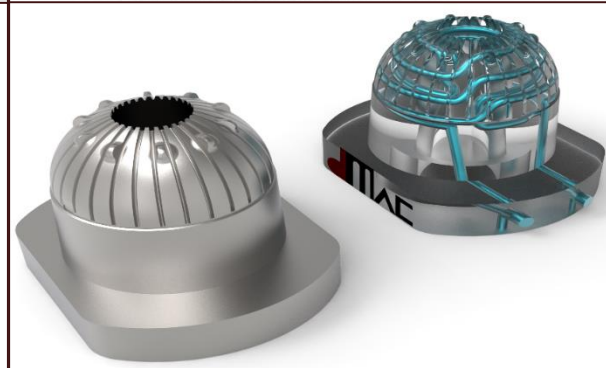
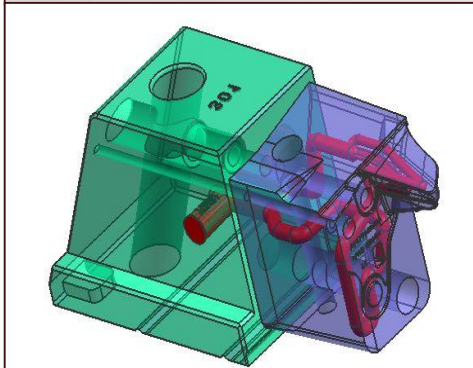
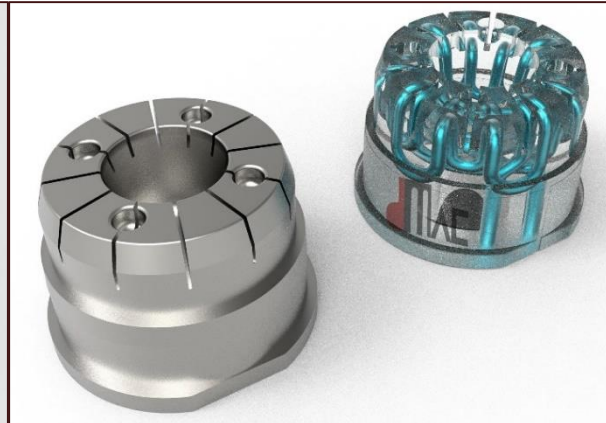
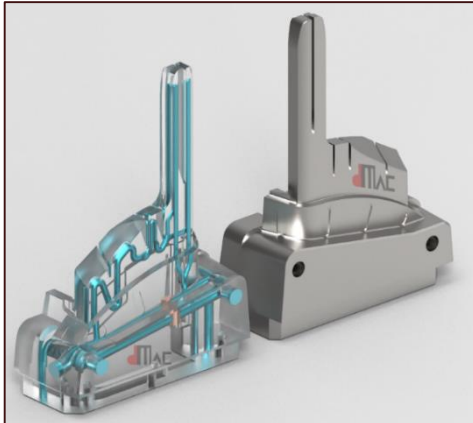
**Sprue  
Bushing  
g**

**Hot-Tip  
Bushing**

**Sub-  
Insert**



## 3D Printing for Tooling Application-2



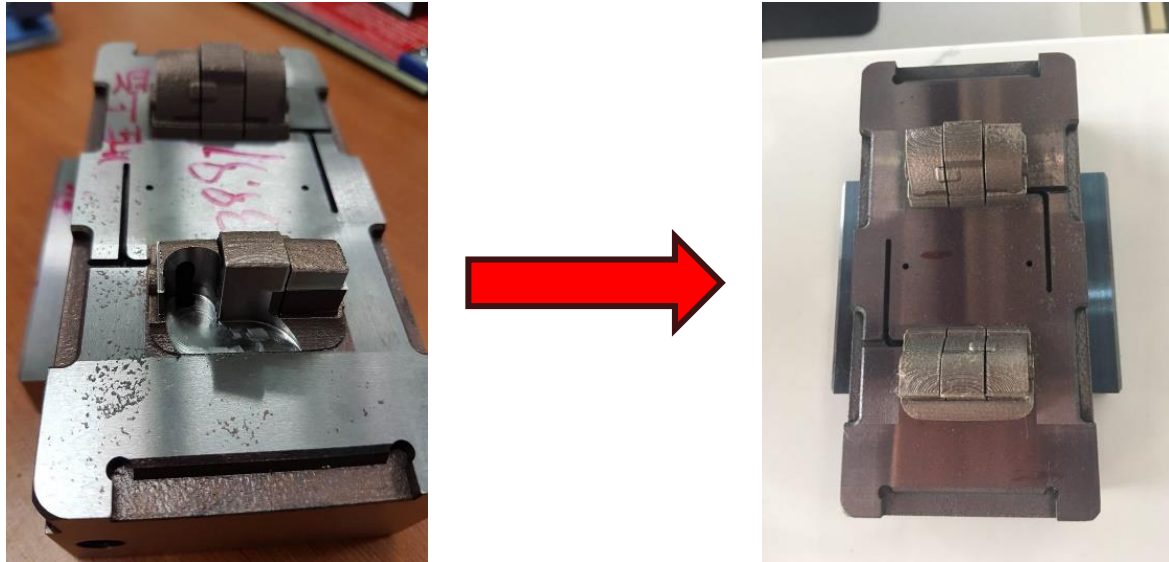
**Slider**

**Round Insert**

**Core Pin**

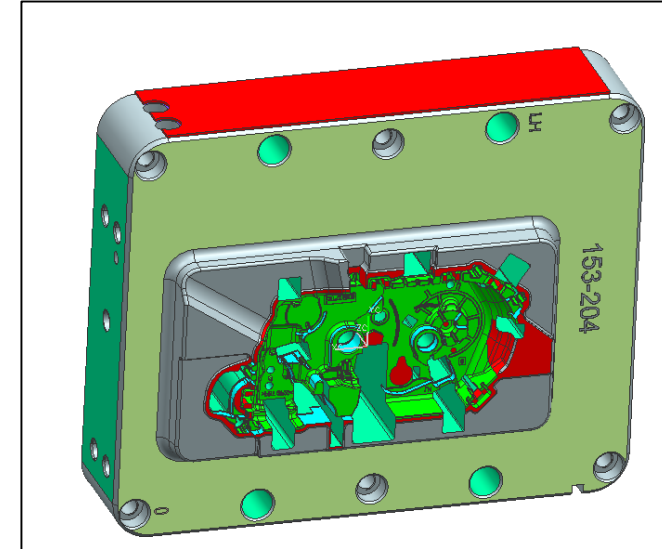
**Lifter**

## 3D printing for mold repair - 1



For example : CNC over-cut during machining due to programming mistake and we can just grind it away the over-cut portion and then re-print on the existing insert

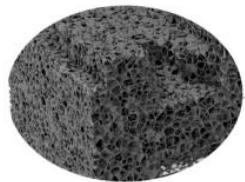
## 3D printing for mold repair - 2



For example : main insert overall size is undersize. Normally we may choose to use welding to repair but welding is not good for insert life span and also cosmetic is not so nice to view. We can then use 3D printing to add small amount of thickness to the undersize surface and then grind it to the required size.



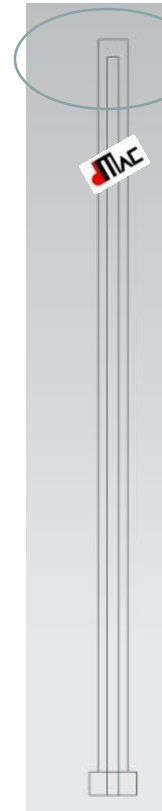
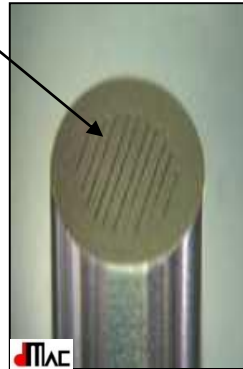
# Air-venting for ejector pin & sub-insert



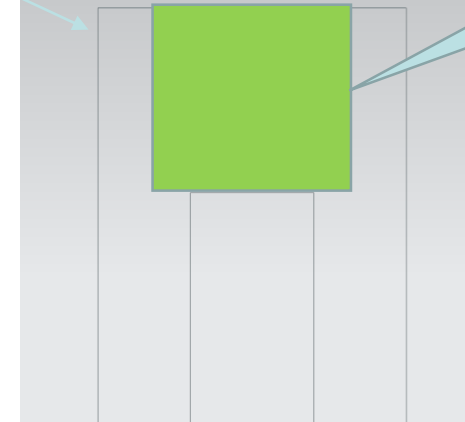
VD130 胶位面，微孔 0.1mm

Venting gap  
between 0.02 to  
0.04mm

Very fine  
venting  
holes



MAC



Very fine  
venting  
holes



MAC