

# TMC MIM Turnkey System

## 金屬粉末射出設備

TMC is recognized as a professional metal injection molding (MIM) system supplier in Taiwan, specialized in producing high strength, high hardness, high complexity, and large volume of small metal parts.

TMC 是台灣專業提供金屬粉末射出 (Metal Powder Injection Molding, 簡稱 MIM) 設備的製造商, 提供整套設備, 製作高強度、高硬度物件, 特別適合大批量小型零件生產, 為生產工藝帶來更大的彈性。

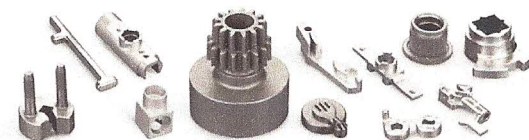
### Comparison of MIM & Other Processes 金屬粉末射出和其他製程特性之比較

各種製程 比較項目	TMC MIM	Powder Metallurgy 粉末冶金	Die Casting 精密鑄造	Forging 鍛造	Machinery 機械加工
Cost 成本	Medium	Excellent	Medium	Medium	Poor
Density 密度	94~99%	<92%	100%	100%	100%
Output 產能	High	High	Medium	Medium	Low
Mechanical Property 機械性質	Good	Fair	Good	Good	Good
Roughness 表面粗糙度	Fine(1um Ra)	Medium	Medium	Rough	Fine
Complexity 形狀複雜度	High	Low	Fair	Low	High
Accuracy 尺寸精度	Fair (0.3%)	High	Fair (0.7%)	Poor	High



## Applications 應用領域

- Computer products & PC peripherals - printer parts, hinges, logos, battery caps and locks.  
電腦及週邊零件：如印表機零件、鉸鏈、商標、電池蓋、鎖。
- Business machinery parts - magnetic core, cams, firing pin and driving parts.  
事務機器零件：磁芯、凸輪、撞針軸銷、驅動零件。
- Communications - hinges, antenna seats in cellular phones, battery caps and fiber optic connectors.  
通訊零件：鉸鏈、電池蓋、手機天線座、光纖接頭。
- Hand tools - drill, cutter, locking clips, nail gun parts, gears and ratchets.  
手工具機構件：如鑽頭、螺旋銼刀、夾鉗、打釘槍零件、齒輪、棘輪。
- Houseware parts - watch cases, band, ring, golf knob and knives.  
家用器具：如錶殼、錶鏈、珠寶鑲環、高爾夫球頭、刀具部件。
- Medical devices - orthodontic tooth alignment parts, forceps, surgical scissors, suture needle and knives.  
醫療機械用零件：如牙矯正架、鑷子、剪刀、縫合針、刀具部件。
- Military parts - warhead, triggers, fuse and guards.  
軍用零件：彈頭、槍械板機、引信及保險。
- Transportation - vehicle clutch inner ring, air bag parts, air and marine parts.  
運輸工具用零件：離合器內環、安全氣囊件、航太及船舶用零件。
- Electronics parts - micromotor parts, inspection and measuring equipment parts.  
電氣用零件：微型馬達、感測器件。



### Strength and Hardness

高強度、高硬度成品

### Small Metal Parts

適合大批小型零件生產

### Product's Complexity

成品形狀更精細

Fe-2%Ni,  
Fe-8%Ni  
鐵-鎳-碳合金

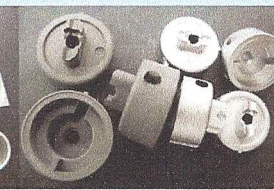
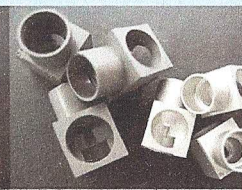
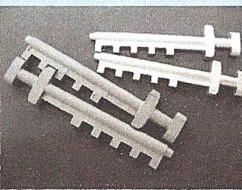
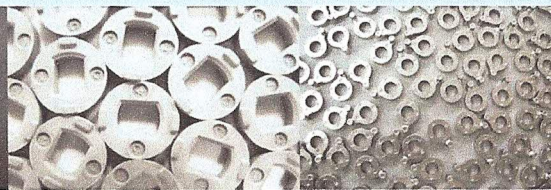
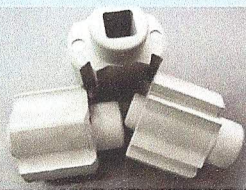
316L, 304L, 630(17-4 PH),  
440C, 420J2, 4140  
不銹鋼合金

M2, SKD11, Kovar(F150),  
Cu, SKH57  
特殊合金

Permalloy PB,  
Permalloy PC, 18 Si-Fe  
軟質磁性合金

## TMC MIM Turnkey System

MIM製程，可以採用材料 [MIM Materials](#)



# TMC MIM Turnkey System 金屬粉末射出設備



## ① Mixing 混合

Mix fine metal powder with thermoplastic binder and additives.  
粉末及結合劑混合。

## ② Kneading 混煉

Use high shear rate kneader to mix binder and metal powder after kneading, the homogeneous feedstock is palletized to facilitate the loading into the molding machine.

將MIM製程基本原料粉末及結合劑透過加熱，使粉末均勻分布在塑膠結合劑基地上，所得均勻體我們稱之為餵料。餵料流動性佳有利於射出成形。

## ③ Injection 射出成形

Inject to form green parts.

將餵料加熱到易於流動溫度，注入模穴之中而後冷卻，過而復始複製工件(此工件又稱生胚)。

## ④ Thermal de-binding 修毛邊

Removing outside and inside ridges and burrs on green parts.

修除工件(生胚)之外部與內部凸起。

## ⑤ Solvent Extraction 淬泡

Extract the binders from green parts leaving the parts with metal powders only. Since the binder has completed its mission after molding, it is extracted from the green parts leaving the parts with metal powders only.

利用溶劑淬取生胚中低熔點結合劑，可加速工件熱脫脂速率，縮短生產週期，亦可不採用此步驟，直接將生胚置入加熱爐，熱脫脂方式去膠。

## ⑥ Vacuum Sintering 真空脫脂燒結

The debound parts are consolidated by holding at high temperatures to attain the required mechanical and physical properties.

採用真空氣氛，高溫1100°C~1400°C，將生胚體中之結合劑去除，完成工件緻密化工程，亦可採用還原氣氛，但真空及高溫下環境可得較佳成品密度及機械性質。

## ⑦ Secondary Operations 後處理

If needed, to proceed with secondary operations like plating, sand blasting, drilling, tapping, heat treating ... etc.

如有必要，進行電鍍、噴砂、鑽孔、攻牙、熱處理等後段製程。

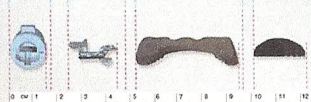


Vacuum sintering machine - Max. temperature 1,600°C  
真空燒結爐最高溫攝氏1,600度

## Green parts 產品燒結前



## After sintering parts 產品燒結後



Green parts and after sintering parts  
產品燒結前後的尺寸變異