



公司距浦東機場約1小時30分車程，距虹橋機場約40分鐘車程。  
Our company is located about one and half hours from Pudong International Airport and 40 minutes from Hongqiao International Airport by car.

粘結釹鐵硼永磁體  
Bonded NdFeB Magnets

異方性注射鐵氧體磁體  
Anisotropic Injection Ferrite Magnets

金屬注射成形產品  
Metal Injection Molding Parts

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## 公司简介 Company Introduction

上海三環磁性材料有限公司(原上海愛普生磁性器件有限公司)成立於1995年，作為北京中科三環高技術股份有限公司和愛普生(中國)有限公司的合資企業，一直專注於粘結釹鐵硼永磁材料和金屬注射成形領域，產品的研發和製造覆蓋粘結釹鐵硼磁體顆粒料、磁體、元件以及金屬注射成形部品等領域。客戶是我們的長期合作夥伴，我們將一如既往地為客戶的專案成功提供全力的支援。

上海三環磁性材料有限公司擁有壓縮成形、注射成形和擠出成形等多種磁體製造工藝以及金屬注射成形工藝，已經獲得IATF16949、ISO9001和ISO14001管理體系認證，並嚴格按照體系要求進行管理，生產線的設計遵循環保理念，大力推廣自動化，通過內部的嚴格品控來確保為客戶提供滿意的產品。

我們的產品廣泛運用於各類高性能馬達和傳感系統，尤其是在車用傳感器及馬達、硬盤主軸馬達、家電產品、電動工具及磁輥等方面。

Shanghai San Huan Magnetics Co., Ltd. (SEM, previously as Shanghai EPSON Magnetics Co., Ltd.) was established in 1995 and is a joint venture between Beijing Zhong Ke San Huan Hi-Tech Co., Ltd. and Epson (China) Co., Ltd. SEM has been focusing on the bonded Nd-Fe-B area and Metal Injection Molding (MIM) area to develop, manufacture and market magnet compound, magnet, magnet assemblies and MIM parts. We always take our customers as long term partners. We will continue to provide full support for the success of our customers' projects.

SEM has various molding processes such as compaction, injection and extrusion for bonded Nd-Fe-B and MIM. We have been awarded certifications of IATF16949, ISO9001 and ISO14001 management system with automatic manufacturing lines which are environment-friendly designed. And we strictly conduct process control and internal quality management to ensure customer satisfaction.

Our products are widely used in high performance motors and sensors such as automobile sensors and motors, HDD spindle motors, home appliance, power tools and magnet rollers, etc.

成立日期：  
FOUNDED: 1995年12月18日  
December 18th 1995

主要產品：  
PRODUCTS: 粘結釹鐵硼磁體  
Bonded NdFeB Magnets  
異方性注射鐵氧體  
Anisotropic Injection Ferrite

生產規模：  
PRODUCTIVITY: 6.0億件/年  
600 Mpcs/Year

經營範圍：  
ENGAGED IN: 稀土類磁體、顆粒料、磁體應用製品、異方性注射鐵氧體以及金屬注射成形制品的開發、製造、銷售及技術服務。  
Designing, producing, selling & technical service for rare earth magnets, magnetic compounds, magnet assemblies, anisotropic injection ferrite and metal injection molding parts.

粘結釹鐵硼磁體顆粒料  
Bonded NdFeB Magnetic Compounds  
金屬注射成形制品  
MIM parts

1,500噸/年  
1,500T/Year

## 公司历史 Company History

### ● 公司歷史 Company History

1970年代 精工愛普生開始開發時鐘用高性能磁體  
1980年代 SmCo系高性能粘結磁體開發及商品化  
1988年 NdFeB系粘結磁體、壓縮成形、注塑成形磁體商品化。用途擴大到HDD主軸馬達和打印機用步進馬達。  
1991年 NdFeB系擠出成形磁體商品化。  
1995年 精工愛普生與上海精密科學儀器有限公司合資設立上海愛普生磁性器件有限公司。  
2002年 精工愛普生的磁石製造部門全部搬遷到上海。SmCo磁體的製造和銷售移交Napac。  
2003年 中國科學院下屬的北京中科三環高技術股份有限公司出資加入上海愛普生磁性器件有限公司。  
2004年 精工愛普生磁石銷售部門及相關部門全部移到上海。北京中科三環高技術股份有限公司控股70%  
2009年 遷入新工場，生產規模達到1,200噸/年。  
2011年 金屬注塑成形產品商品化。  
2015年 企業名稱變更為上海三環磁性材料有限公司。

In 1970s SEIKO-EPSON started to develop high-performance magnet for clock and watch.  
In 1980s High-performance bonded magnet of SmCo series was launched to market.  
In 1988 NdFeB Series - Compaction mold and injection mold were launched to market, which were utilized in HDD motor and printer stepping motor fields.  
In 1991 NdFeB Series - Extrusion mold were launched to market.  
In 1995 Shanghai Epson Magnetics Co., Ltd. (SEM) was established by Seiko Epson Corporation and Shanghai Precision & Scientific Co., Ltd.  
In 2002 Seiko Epson transferred the production of Bonded NdFeB magnet to Shanghai plant. SmCo Magnet business was transferred to Napac Co., Ltd.  
In 2003 Beijing Zhong Ke San Huan High-Tech Co., Ltd. joined SEM.  
In 2004 Seiko Epson transferred the whole business of magnet including sales department to SEM. Beijing Zhong Ke San Huan High-Tech Co., Ltd. took the share of 70%.  
In 2009 SEM moved to the new factory. Production scale reached 1,200 tons / year.  
In 2011 Metal injection mold parts were launched to market.  
In 2015 Company name was changed to Shanghai San Huan Magnetics Co., Ltd.

## 管理體系認證 Certificates of Management System

### IATF 16949



### ISO 9001



### ISO 14001



# 粘結釹鐵硼永磁體

## Bonded NdFeB Magnets

### 產品一覽 Products Overview



#### 獨有專利技術 --- 磁體擠出成形

#### Unique Technique --- Extrusion Molding of Magnet

本公司在全球首次推出 NdFeB 擠出成形粘結磁體，並且是唯一的製造商。該類磁體具有下述出色的特性，可供客戶在應用選擇時參考。

Our company was the first and is the sole manufacturer to supply extrusion molded NdFeB bonded magnets in the world. Advantages are listed below to enable our customers to develop new applications.

- 連續性擠出成形使磁體沿長度方向的尺寸、性能幾乎沒有偏差，錐度可以忽略不計。

Magnets are continuously extruded to keep the same dimensions and properties along the length. Taper is negligible.

- 磁體可以加工成長至一米以上，而且同一套模具能對應不同長度的產品。

Magnets of over 1 meter in length can be achieved. And one set of hard tools can make products of different lengths.

- 與壓縮成形磁體相比，孔隙率低，耐腐蝕性好，按用途要求磁體可無需塗裝。

Extruded magnets have lower porous ratio and better corrosion resistance than compression molded ones. For certain applications coating is unnecessary.

- 與注射成形磁體相比樹脂含量較低，所以磁性能可以做得更高。

Higher performance can be expected for less resin composition than injection molded magnets.

### 設備與設施 Equipments and Facilities



### 檢測與分析 Inspection and Analysis



磁體用途實例 Typical Applications

- 硬盤、光盤驅動器主軸馬達
  - 車載用直流馬達
  - 家電用馬達
  - 電動工具用馬達
  - 工業用DC馬達
  - OA用馬達及磁輥
- HDD、ODD spindle motor
  - Automobile DC motor
  - Home Appliance motor
  - Power Tool motor
  - Industrial DC motor
  - OA motor and magroll

應用典型 Typical Examples of Applications

● 硬盤主軸馬達磁體  
HDD Spindle motors magnet



● 車載用磁體  
Automobile Application magnet



● 家電用磁體  
Home Application magnet



● 電動工具磁體  
Power Tool magnet



● 工業用磁體  
Industrial Application magnet



● OA用磁體  
OA Application magnet



材料使用建議 Suggestions for use of magnetic materials

| 材料系列<br>Material Series | 成形方法<br>Molding Methods    | 推薦形狀<br>Shape Recommended                                          | 牌號<br>Grade | 樹脂<br>Resin         | 選擇建議<br>Choice Reference                                     | 最高<br>工作溫度<br>Max. Tw/ °C |
|-------------------------|----------------------------|--------------------------------------------------------------------|-------------|---------------------|--------------------------------------------------------------|---------------------------|
| NEOM                    | 壓縮成形<br>Compaction molding | 圓環形、瓦形、<br>方塊、圓柱<br>Ring,<br>Tile shape,<br>Block,<br>Cylinder     | NEOM-2      | 環氧樹脂<br>Epoxy resin | 可替代鐵氧體磁體<br>To replace ferrite magnet                        | 160                       |
|                         |                            |                                                                    | NEOM-4      |                     | 标准型<br>Standard                                              | 160                       |
|                         |                            |                                                                    | NEOM-6      |                     | 高性能、高強度<br>High performance, High strength                   | 160                       |
|                         |                            |                                                                    | NEOM-8      |                     | 高矯頑力磁粉<br>High Hcj magnetic powder                           | 180                       |
|                         |                            |                                                                    | NEOM-8+     |                     | 标准型<br>Standard                                              | 160                       |
|                         |                            |                                                                    | NEOM-8H     |                     | 高性能、高強度<br>High performance, High strength                   | 160                       |
|                         |                            |                                                                    | NEOM-10     |                     | 标准型<br>Standard                                              | 160                       |
|                         |                            |                                                                    | NEOM-10+    |                     | 高性能、高強度<br>High performance, High strength                   | 160                       |
|                         |                            |                                                                    | NEOM-12     |                     | 标准型<br>Standard                                              | 160                       |
|                         |                            |                                                                    | NEOM-12L    |                     | 易充磁<br>Easy magnetizing                                      | 160                       |
|                         |                            |                                                                    | NEOM-12E    |                     | 高性能、高強度<br>High performance, High strength                   | 160                       |
|                         |                            |                                                                    | NEOM-13E    |                     | 高性能、高強度<br>High performance, High strength                   | 160                       |
|                         |                            |                                                                    | NEOM-13L    |                     | 易充磁<br>Easy magnetizing                                      | 160                       |
| NEOLET                  | 注塑成形<br>Injection molding  | 複雜幾何形狀<br>Complex geometry                                         | NEOLET-3R   | 聚苯硫醚<br>PPS         | 耐高温<br>Durable for high temperature                          | 180                       |
|                         |                            |                                                                    | NEOLET-3HR  |                     |                                                              |                           |
|                         |                            |                                                                    | NEOLET-6R   |                     | 高強度、耐高温<br>High strength<br>Durable for high temperature     | 180                       |
|                         |                            |                                                                    | NEOLET-6HR  |                     |                                                              |                           |
|                         |                            |                                                                    | NEOLET-7R   |                     |                                                              |                           |
|                         |                            |                                                                    | NEOLET-440R |                     |                                                              |                           |
|                         |                            |                                                                    | NEOLET-550R |                     |                                                              |                           |
|                         |                            |                                                                    | NEOLET-650R | 尼龍<br>PA            | 标准型<br>Standard                                              | 130                       |
|                         |                            |                                                                    | NEOLET-5    |                     | 高性能<br>High performance                                      | 130                       |
|                         |                            |                                                                    | NEOLET-6    |                     |                                                              |                           |
|                         |                            |                                                                    | NEOLET-8    | 尼龍<br>PA            | 長尺寸、小錐度、密度均勻<br>Long length, Small taper,<br>Uniform density | 130                       |
|                         |                            |                                                                    | NEODEX-5    |                     |                                                              |                           |
|                         |                            |                                                                    | NEODEX-8    |                     |                                                              |                           |
|                         |                            |                                                                    | NEODEX-10   |                     |                                                              |                           |
| NEODEX                  | 擠出成形<br>Extrusion molding  | 長尺寸圓環<br>和瓦形<br>Long length<br>ring and tile<br>shape<br>(L/D ≥ 3) | NEODEX-11   |                     |                                                              |                           |

注：注射成形用顆粒料性能規格與NEOLET相同，可參見NEOLET系列。  
Note: Compound for injection molding has the same performance specifications as NEOLET. Please refer to the NEOLET series.

○ 公司簡介  
● 粘結釹鐵硼永磁磁體  
○ 異方性注射鐵氧體磁體  
○ 多元化產品  
○ 注意事項  
○ 金屬注射成形產品

產品性能 Properties of Products

● 壓縮系列 Compression Series

|                                                                         | NEOM-2             | NEOM-4             | NEOM-6             | NEOM-8              | NEOM-8+             | NEOM-8H               |
|-------------------------------------------------------------------------|--------------------|--------------------|--------------------|---------------------|---------------------|-----------------------|
| 剩餘磁感應強度 $B_r$ (mT)<br>Residual induction (kGs)                          | 290~390<br>2.9~3.9 | 430~530<br>4.3~5.3 | 550~650<br>5.5~6.5 | 620~680<br>6.2~6.8  | 640~700<br>6.4~7.0  | 650~710<br>6.5~7.1    |
| 矯頑力 $H_{cb}$ (kA/m)<br>Coercive force (kOe)                             | 200~280<br>2.5~3.5 | 250~360<br>3.2~4.5 | 310~410<br>3.9~5.1 | 360~440<br>4.5~5.5  | 400~480<br>5.0~6.0  | 400~480<br>5.0~6.0    |
| 內稟矯頑力 $H_{cj}$ (kA/m)<br>Intrinsic coercive force (kOe)                 | 560~720<br>7.0~9.0 | 560~720<br>7.0~9.0 | 560~720<br>7.0~9.0 | 640~800<br>8.0~10.0 | 640~800<br>8.0~10.0 | 875~1114<br>11.0~14.0 |
| 最大磁能積 $(BH)_{max}$ (kJ/m³)<br>Max.energy product (MGOe)                 | 16~32<br>2.0~4.0   | 32~48<br>4.0~6.0   | 48~60<br>6.0~7.5   | 60~68<br>7.5~8.5    | 64~72<br>8.0~9.0    | 68~76<br>8.5~9.5      |
| 飽和磁化場 $H_s$ (kA/m)<br>Saturation magnetizing force (kOe)                | ≥ 1280<br>≥ 16     | ≥ 1280<br>≥ 16     | ≥ 1280<br>≥ 16     | ≥ 1600<br>≥ 20      | ≥ 1600<br>≥ 20      | ≥ 2000<br>≥ 25        |
| 回復磁導率 $\mu_{rec}$<br>Recoil permeability                                | 1.2                | 1.2                | 1.2                | 1.2                 | 1.2                 | 1.2                   |
| 剩磁可逆溫度係數 $\alpha (B_r)$ (%/°C)<br>Reversible temp. coefficient of $B_r$ | -0.12              | -0.12              | -0.12              | -0.12               | -0.12               | -0.13                 |
| 居裡溫度 $T_c$ (°C)<br>Curie temperature                                    | 305                | 305                | 305                | 305                 | 305                 | 305                   |
| 最大工作溫度 (°C)<br>Max.operating temperature                                | 160                | 160                | 160                | 160                 | 160                 | 180                   |
| 密度(未塗裝) $\rho$ (g/cm³)<br>Density (Without coating)                     | 4.6~5.4            | 5.2~6.2            | 5.5~6.3            | 5.9~6.3             | 6.0~6.4             | 6.0~6.4               |

[注] note:  
- H: 高矯頑力磁粉 High Hcj Powder  
L: 低矯頑力磁粉 Low Hcj Powder  
E: 耐熱增強型 Enhanced Type of Heat Resistant

- 對於某一特定形狀和尺寸的磁體,其磁性能的實際波動範圍比上表所示的要更窄。如果需要,使用者可以按上述範圍設定更窄的磁性能規格。  
- For a certain shape and size of magnet, the actual variation range of the magnetic properties is narrower than that shown in the table above. The user can set a much narrower magnetic specification according to the above range, if necessary.



產品性能 Properties of Products

|                                                                         | NEOM-10             | NEOM-10+            | NEOM-12             | NEOM-12L           | NEOM-12E            | NEOM-13E            | NEOM-13L            |
|-------------------------------------------------------------------------|---------------------|---------------------|---------------------|--------------------|---------------------|---------------------|---------------------|
| 剩餘磁感應強度 $B_r$ (mT)<br>Residual induction (kGs)                          | 680~720<br>6.8~7.2  | 700~750<br>7.0~7.5  | 720~760<br>7.2~7.6  | 730~780<br>7.3~7.8 | 750~800<br>7.5~8.0  | 760~800<br>7.6~8.3  | 760~830<br>7.6~8.3  |
| 矯頑力 $H_{cb}$ (kA/m)<br>Coercive force (kOe)                             | 400~480<br>5.0~6.0  | 400~480<br>5.0~6.0  | 440~520<br>5.5~6.5  | 400~460<br>5.0~5.8 | 440~520<br>5.5~6.5  | 440~520<br>5.5~6.5  | 400~480<br>5.0~6.0  |
| 內稟矯頑力 $H_{cj}$ (kA/m)<br>Intrinsic coercive force (kOe)                 | 640~800<br>8.0~10.0 | 640~800<br>8.0~10.0 | 720~800<br>9.0~10.0 | 480~640<br>6.0~8.0 | 720~840<br>9.0~10.5 | 720~840<br>9.0~10.5 | 480~640<br>6.0~8.0  |
| 最大磁能積 $(BH)_{max}$ (kJ/m³)<br>Max.energy product (MGOe)                 | 72~80<br>9.0~10.0   | 76~84<br>9.5~10.5   | 84~96<br>10.5~12.0  | 80~96<br>10.0~12.0 | 88~100<br>11.0~12.5 | 88~104<br>11.0~13.0 | 88~104<br>11.0~13.0 |
| 飽和磁化場 $H_s$ (kA/m)<br>Saturation magnetizing force (kOe)                | ≥ 1600<br>≥ 20      | ≥ 1600<br>≥ 20      | ≥ 1600<br>≥ 20      | ≥ 1280<br>≥ 16     | ≥ 1600<br>≥ 20      | ≥ 1600<br>≥ 20      | ≥ 1280<br>≥ 16      |
| 回復磁導率 $\mu_{rec}$<br>Recoil permeability                                | 1.2                 | 1.2                 | 1.2                 | 1.2                | 1.2                 | 1.2                 | 1.2                 |
| 剩磁可逆溫度係數 $\alpha (B_r)$ (%/°C)<br>Reversible temp. coefficient of $B_r$ | -0.12               | -0.12               | -0.11               | -0.11              | -0.10               | -0.10               | -0.10               |
| 居裡溫度 $T_c$ (°C)<br>Curie temperature                                    | 305                 | 305                 | 320                 | 320                | 350                 | 350                 | 350                 |
| 最大工作溫度 (°C)<br>Max.operating temperature                                | 160                 | 160                 | 160                 | 160                | 160                 | 160                 | 160                 |
| 密度(未塗裝) $\rho$ (g/cm³)<br>Density (Without coating)                     | 5.9~6.3             | 6.1~6.4             | 6.0~6.3             | 6.1~6.4            | 6.1~6.4             | 6.1~6.4             | 6.1~6.4             |

● 力學性能和其他物理性能 Mechanical & Other Physical Properties

| 項目 Item                             | 單位 Unit              | 参数 Value  |
|-------------------------------------|----------------------|-----------|
|                                     |                      | NEOM      |
| 拉伸強度 Tensile strength               | MPa                  | —         |
| 缺口衝擊強度 Notched impact strength      | kJ/m²                | 2.1~3.5   |
| 楊氏彈性模量 Young's modulus              | 10 <sup>4</sup> MPa  | 2.0~3.5   |
| 熱膨脹係數 Thermal expansion coefficient | 10 <sup>-5</sup> /°C | 1.1~1.4   |
| 電阻率 Electric resistivity            | Ω·m                  | 0.02~0.04 |
| 硬度 Hardness                         | HRM                  | 100~130   |

產品性能 Properties of Products

產品性能 Properties of Products

● 注射擠出系列磁性能  
Injection and Extrusion Series

|                                       |         |  | 注射系列 Injection Series |            |             |           |             |           | 注射系列 Injection Series |            |             |           | 擠出系列 Extrusion Series |           |           |           |           |
|---------------------------------------|---------|--|-----------------------|------------|-------------|-----------|-------------|-----------|-----------------------|------------|-------------|-----------|-----------------------|-----------|-----------|-----------|-----------|
|                                       |         |  | NEOLET-3R             | NEOLET-3HR | NEOLET-440R | NEOLET-5  | NEOLET-550R | NEOLET-6  | NEOLET-6R             | NEOLET-6HR | NEOLET-650R | NEOLET-7R | NEOLET-8              | NEODEX-5  | NEODEX-8  | NEODEX-10 | NEODEX-11 |
| 剩餘磁感應強度 $B_r$                         | (mT)    |  | 370~420               | 420~470    | 430~480     | 500~550   | 470~520     | 550~610   | 500~560               | 490~550    | 500~560     | 520~580   | 610~670               | 450~520   | 615~675   | 650~720   | 670~730   |
| Residual induction                    | (kGs)   |  | 3.70~4.20             | 4.20~4.70  | 4.30~4.80   | 5.00~5.50 | 4.70~5.20   | 5.50~6.10 | 5.00~5.60             | 4.90~5.50  | 5.00~5.60   | 5.20~5.80 | 6.1~6.7               | 4.50~5.20 | 6.15~6.75 | 6.50~7.20 | 6.70~7.30 |
| 矯頑力 $H_{cb}$                          | (kA/m)  |  | 250~330               | 260~340    | 270~350     | 310~390   | 300~395     | 340~415   | 340~415               | 315~395    | 315~395     | 325~375   | 380~420               | 280~350   | 380~450   | 360~450   | 410~460   |
| Coercive force                        | (kOe)   |  | 3.1~4.1               | 3.3~4.3    | 3.4~4.4     | 3.9~4.9   | 3.75~4.96   | 4.2~5.2   | 4.2~5.2               | 3.95~4.96  | 3.95~4.96   | 4.0~4.7   | 4.75~5.25             | 3.5~4.4   | 4.75~5.6  | 4.5~5.6   | 5.1~5.8   |
| 內稜矯頑力 $H_{cj}$                        | (kA/m)  |  | 640~800               | 850~1114   | 850~1114    | 640~800   | 850~1114    | 640~800   | 640~800               | 850~1114   | 850~1114    | 640~800   | 640~800               | 640~800   | 640~800   | 640~800   | 640~800   |
| Intrinsic coercive force              | (kOe)   |  | 8.0~10.0              | 10.7~14.0  | 10.7~14.0   | 8.0~10.0  | 10.7~14.0   | 8.0~10.0  | 8.0~10.0              | 10.7~14.0  | 10.7~14.0   | 8.0~10.0  | 8.0~10.0              | 8.0~10.0  | 8.0~10.0  | 8.0~10.0  | 8.0~10.0  |
| 最大磁能積 $(BH)_{max}$                    | (kJ/m³) |  | 24~32                 | 28~36      | 28~36       | 44~52     | 36~44       | 52~60     | 42~50                 | 40~48      | 42~50       | 48~56     | 60~68                 | 32~44     | 60~68     | 64~80     | 68~88     |
| Max.energy product                    | (MGOe)  |  | 3.0~4.0               | 3.5~4.5    | 3.5~4.5     | 5.5~6.5   | 4.5~5.5     | 6.5~7.5   | 5.25~6.25             | 5.0~6.0    | 5.25~6.25   | 6.0~7.0   | 7.5~8.5               | 4.0~5.5   | 7.5~8.5   | 8.0~10.0  | 8.5~11    |
| 飽和磁化場 $H_s$                           | (kA/m)  |  | ≥ 1600                | ≥ 2000     | ≥ 2000      | ≥ 1600    | ≥ 2000      | ≥ 1600    | ≥ 1600                | ≥ 2000     | ≥ 2000      | ≥ 1600    | ≥ 1600                | ≥ 1600    | ≥ 1600    | ≥ 1600    | ≥ 1600    |
| Saturation magnetizing force          | (kOe)   |  | ≥ 20                  | ≥ 25       | ≥ 25        | ≥ 20      | ≥ 25        | ≥ 20      | ≥ 20                  | ≥ 25       | ≥ 25        | ≥ 20      | ≥ 20                  | ≥ 20      | ≥ 20      | ≥ 20      | ≥ 20      |
| 回復磁導率 $\mu_{rec}$                     |         |  | 1.2                   | 1.2        | 1.2         | 1.2       | 1.2         | 1.2       | 1.2                   | 1.2        | 1.2         | 1.2       | 1.2                   | 1.2       | 1.2       | 1.2       | 1.2       |
| Recoil permeability                   |         |  |                       |            |             |           |             |           |                       |            |             |           |                       |           |           |           |           |
| 剩磁可逆溫度係數 $\alpha (B_r)$               | (%/°C)  |  | -0.13                 | -0.13      | -0.12       | -0.12     | -0.12       | -0.11     | -0.11                 | -0.12      | -0.12       | -0.11     | -0.11                 | -0.12     | -0.11     | -0.11     | -0.11     |
| Reversible temp. coefficient of $B_r$ |         |  |                       |            |             |           |             |           |                       |            |             |           |                       |           |           |           |           |
| 居裡溫度 $T_c$                            | (°C)    |  | 305                   | 305        | 305         | 305       | 305         | 330       | 360                   | 305        | 305         | 360       | 330                   | 305       | 330       | 360       | 360       |
| Curie temperature                     |         |  |                       |            |             |           |             |           |                       |            |             |           |                       |           |           |           |           |
| 最大工作溫度                                | (°C)    |  | 180                   | 180        | 180         | 130       | 180         | 130       | 180                   | 130        | 180         | 180       | 130                   | 130       | 130       | 130       | 130       |
| Max.operation temperature             |         |  |                       |            |             |           |             |           |                       |            |             |           |                       |           |           |           |           |
| 密度(未塗裝) $\rho$                        | (g/cm³) |  | 4.2~4.7               | 4.5~5.0    | 4.5~5.0     | 5.0~5.5   | 4.7~5.2     | 5.0~5.5   | 5.0~5.5               | 5.0~5.5    | 5.0~5.5     | 5.0~5.5   | 5.5~6.0               | 5.5~5.8   | 5.5~6.0   | 5.7~6.1   | 5.7~6.1   |
| Density (Without coating)             |         |  |                       |            |             |           |             |           |                       |            |             |           |                       |           |           |           |           |

[注] note:  
- H: 高矯頑力磁粉 High Hcj Powder

- 對於某一特定形狀和尺寸的磁體,其磁性能的實際波動範圍比上表所示的要更窄。如果需要,使用者可以按上述範圍設定更窄的磁性能規格。

- For a certain shape and size of magnet, the actual variation range of the magnetic properties is narrower than that shown in the table above. The user can set a much narrower magnetic specification according to the above range, if necessary.

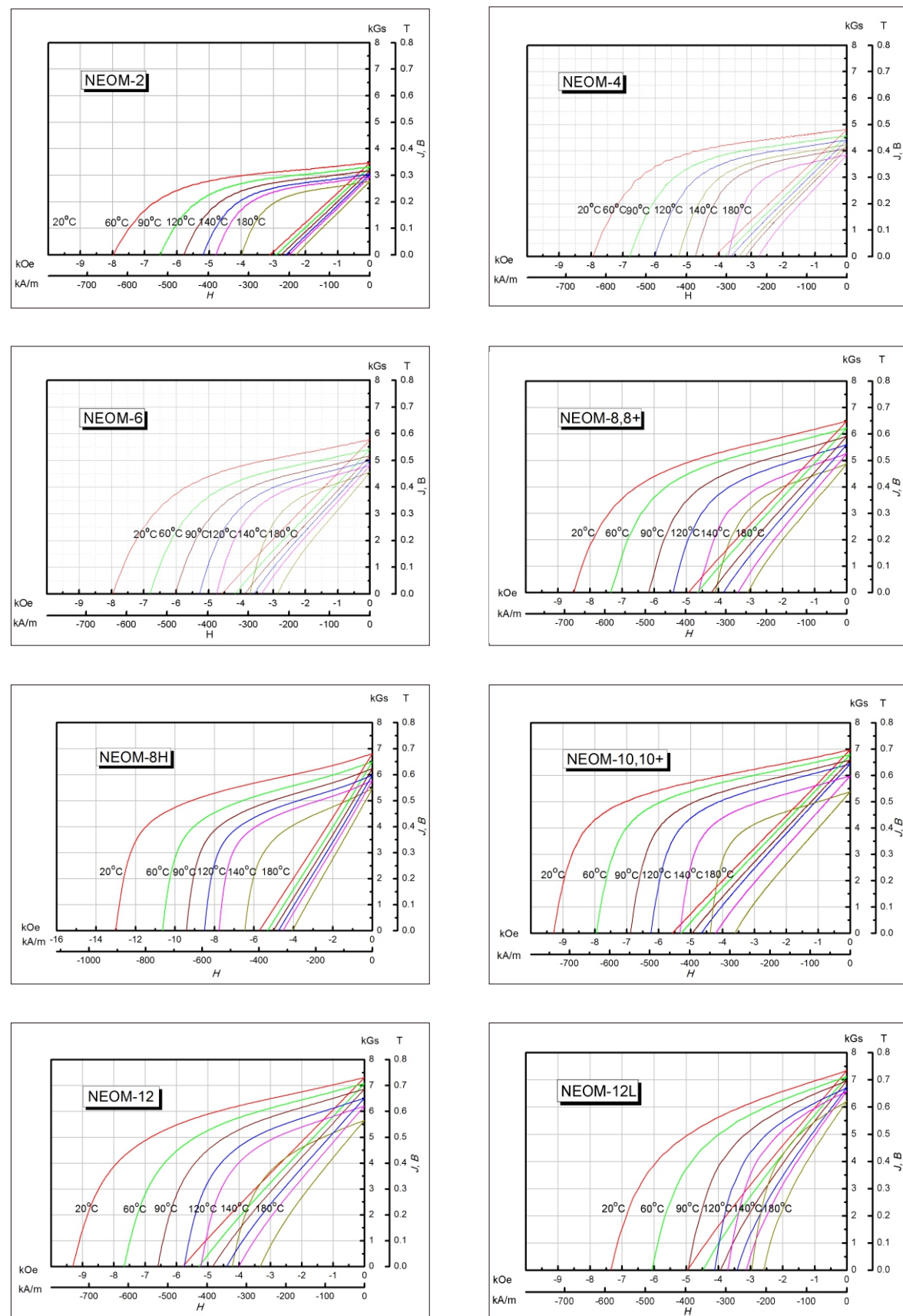


● 力學性能和其他物理性能 Mechanical & Other Physical Properties

| 項目 Item                             | 單位 Unit              | 参数 Value   |           |            |
|-------------------------------------|----------------------|------------|-----------|------------|
|                                     |                      | NEODEX PA  | NEOLET PA | NEOLET PPS |
| 拉伸强度 Tensile strength               | MPa                  | 30~55      | 35~60     | 35~55      |
| 缺口衝擊強度 Notched impact strength      | kJ/m²                | 2.5~4.0    | 3.0~4.5   | 2.1~3.6    |
| 楊氏彈性模量 Young's modulus              | 10 <sup>4</sup> MPa  | 3.5~5.0    | 3.0~4.5   | 3.5~4.0    |
| 熱膨脹係數 Thermal expansion coefficient | 10 <sup>-5</sup> /°C | 3.0~4.5    | 3.5~5.0   | 1.0~2.5    |
| 電阻率 Electric resistivity            | Ω·m                  | 0.015~0.04 | 0.02~0.04 | 0.01~0.03  |
| 硬度 Hardness                         | HRM                  | 100~120    | 80~100    | 100~120    |

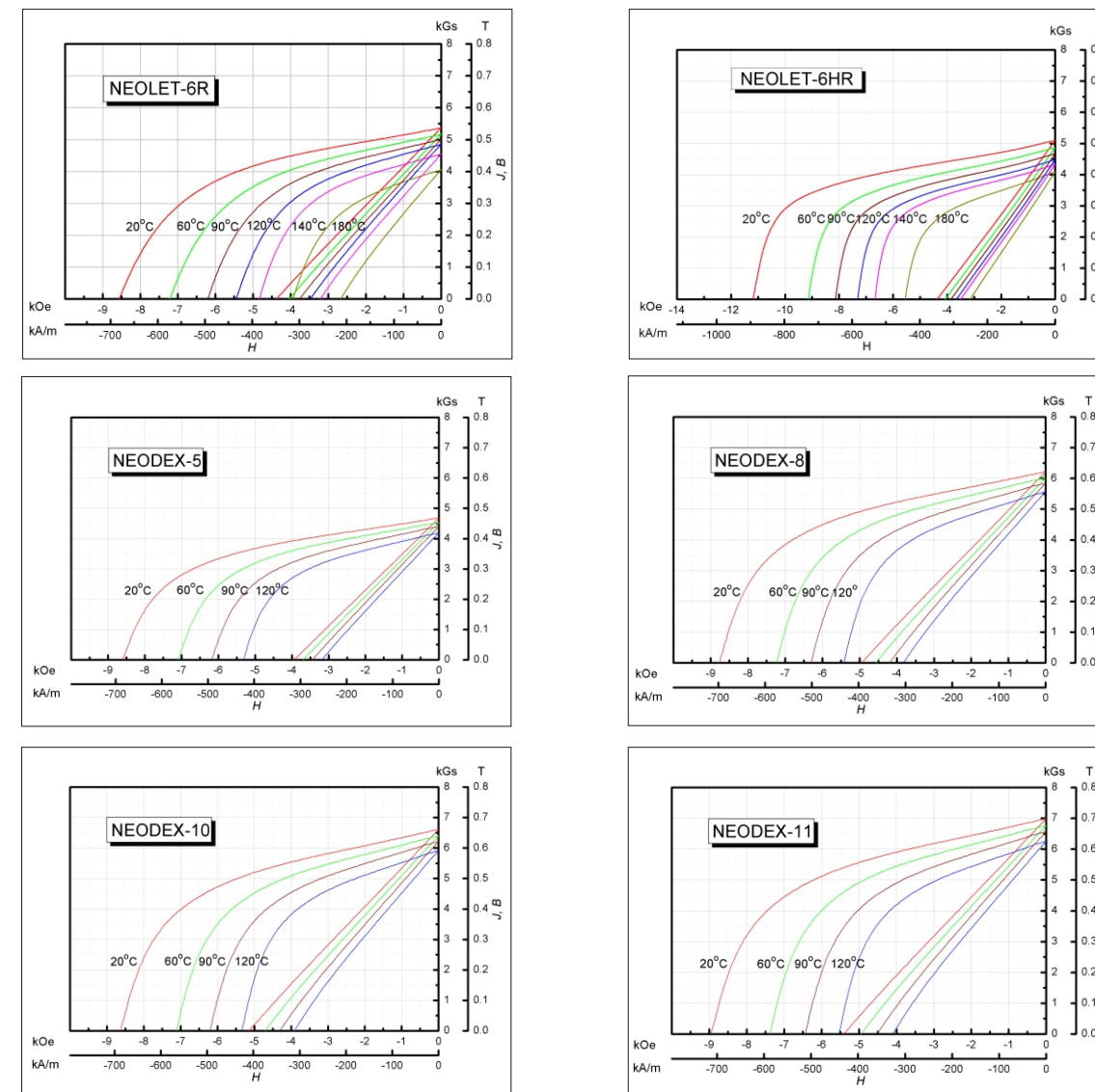
## 高溫退磁曲線 High Temp. Demagnetization Curves

### ● 壓縮系列 Compaction Series



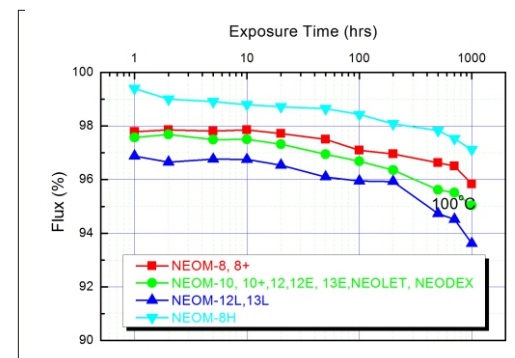
## 高溫退磁曲線 High Temp. Demagnetization Curves

### ● 注射、擠出系列 Injection / Extrusion Series

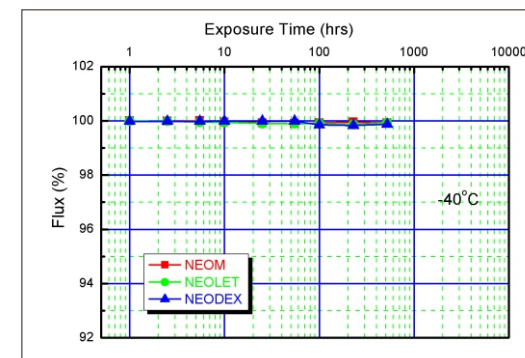


## 長時間不可逆溫度特性 Long Term Irreversible Loss

### ● 高溫特性 High Temperature



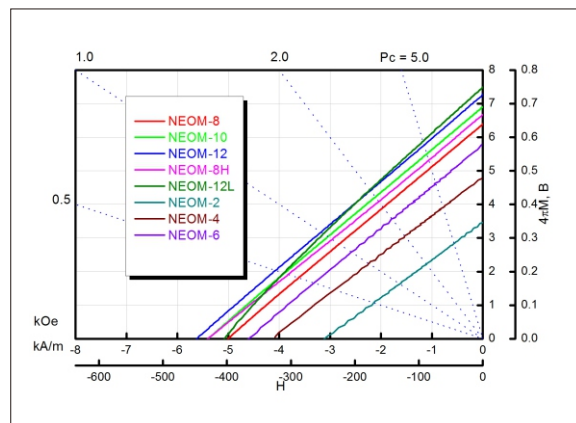
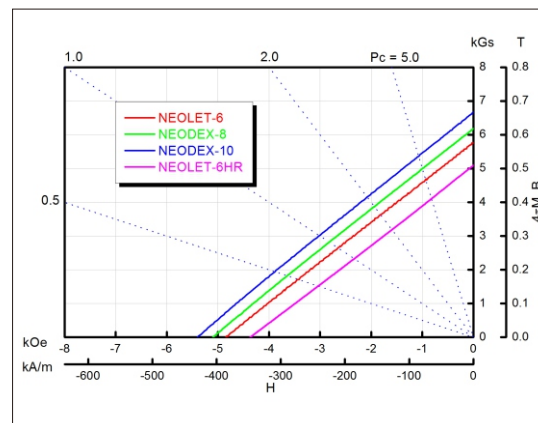
### ● 低溫特性 Low Temperature



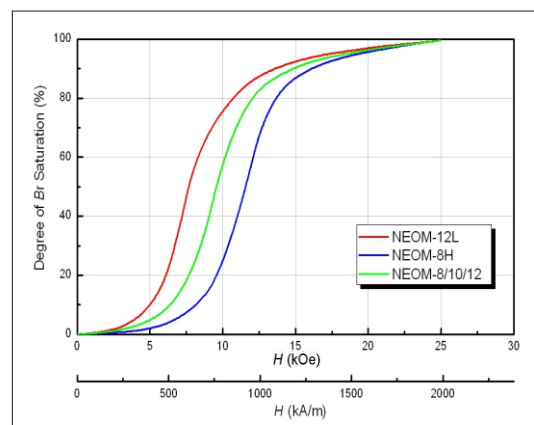
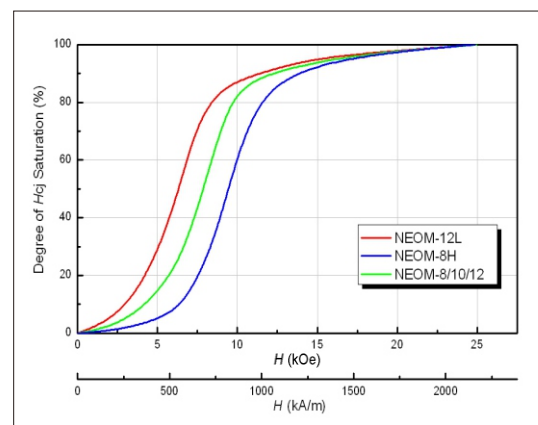
尺寸、形狀不同時，以上數據會有差異。

The above figures are subject to change depending on magnet shape and dimensions.

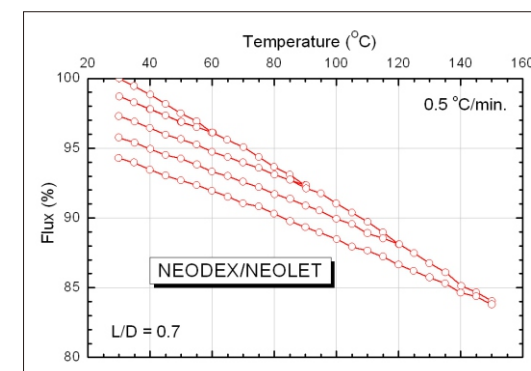
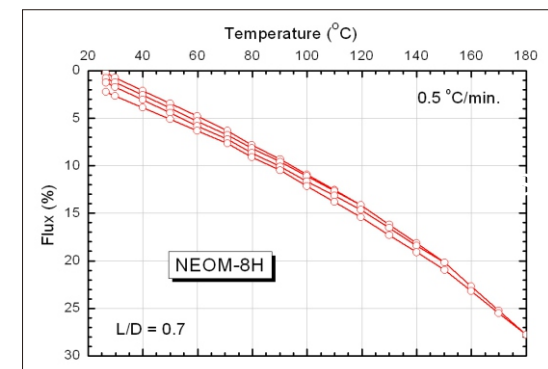
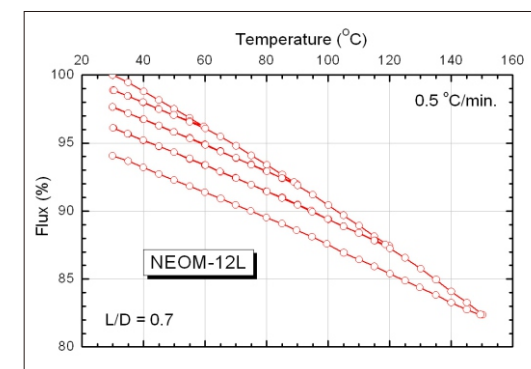
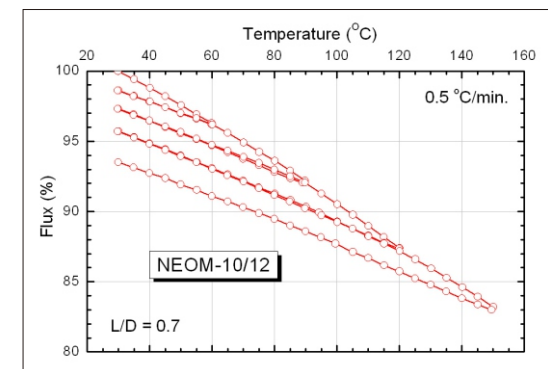
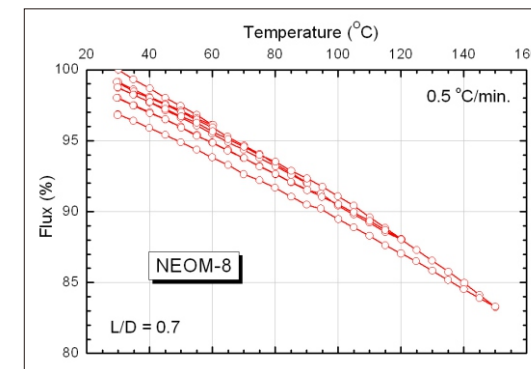
## 室溫退磁曲線 Demagnetization Curves at RT

● 壓縮系列  
Compaction Series● 注射、擠出系列  
Injection / Extrusion Series

## 磁化特性曲線 Feature of Magnetization

● 剩磁飽和趨勢  
Saturation Trends of  $B_r$ ● 內稟矯頑力飽和趨勢  
Saturation Trends of  $H_{cj}$ 

## 可逆溫度特性 Reversible Loss



【鄭人之取玉也，載司南之車，  
為其不惑也。】

《鬼谷子·謀》（公元前四百年）

【司南之杓，投之于地，  
其柢指南】

《論衡·是應》（東漢）

# 異方性注射鐵氧體磁體

## Anisotropic Injection Ferrite Magnets

基於市場的需求和重要客戶的建議，我們從2006年開始投入注塑鐵氧體的研發。在原有鈹鐵硼和MIM 產品的注塑經驗基礎上，我們很快實現量產化，從2009年開始向市場提供穩定的量產品。產品廣泛運用於汽車領域，如速度儀錶傳感器、雨刮傳感器、車窗傳感器、速度控制傳感器、車用水泵、車用油泵等。在鐵氧體專案方面我們同樣將一如既往地全力配合客戶共同開發。

As per the requirement from market and our valuable customers, we started to develop injection ferrite since 2006 and started mass production in 2009 based on our plenty experience in both bonded NdFeB and MIM area. Our products are widely used in automotive area such as speed meters, wiper sensors, window lift sensors, speed control sensors, water pumps, oil pumps, etc. We will try our best to cooperate with our valuable customers for new applications all the time.

## 設備與設施 Equipments and Facilities



## 產品一覽 Products Overview



## 應用典型 Typical Examples of Applications

車載用磁體 Automobile application magnet



電動工具磁體 Power tool motor

冷卻系統馬達 Cooling system motor



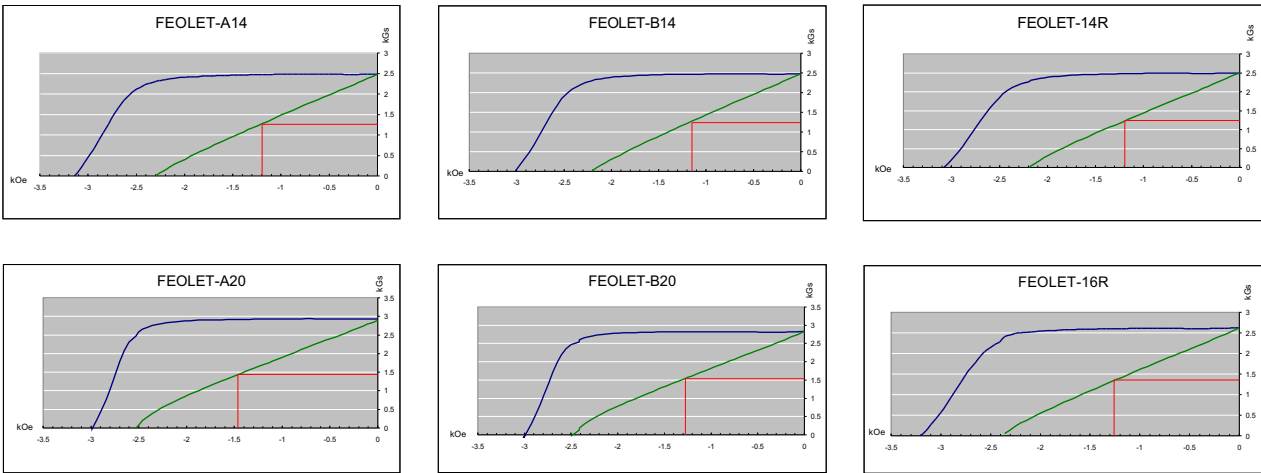
車載用磁體 Automobile application magnet

產品性能 Properties of Products

● 異方性注射鐵氧體性能與物理性能  
Magnetic & Physical Properties of Anisotropic Injection Ferrite Series

| 牌号 Grade (SEMAG)                                                                    |                     |         | FEOLET-A10                                                                                                                          | FEOLET-A14 | FEOLET-A20 | FEOLET-A22 |
|-------------------------------------------------------------------------------------|---------------------|---------|-------------------------------------------------------------------------------------------------------------------------------------|------------|------------|------------|
| 基体 Resin Binder                                                                     |                     |         | PA6                                                                                                                                 |            |            |            |
| 剩餘磁感應強度<br>Residual induction                                                       | Br                  | mT      | 213                                                                                                                                 | 245        | 293        | 305        |
|                                                                                     |                     | Gs      | 2130                                                                                                                                | 2450       | 2930       | 3050       |
| 矯頑力<br>Coercive force                                                               | Hcb                 | kA/m    | 162                                                                                                                                 | 183        | 193        | 191        |
|                                                                                     |                     | Oe      | 2040                                                                                                                                | 2300       | 2420       | 2400       |
|                                                                                     | Hcj                 | kA/m    | 279                                                                                                                                 | 251        | 223        | 229        |
|                                                                                     |                     | Oe      | 3500                                                                                                                                | 3150       | 2800       | 2870       |
| 最大磁能積<br>Maximum energy product                                                     | (BH) <sub>max</sub> | kJ/m³   | 8.8                                                                                                                                 | 11.9       | 16.6       | 18.1       |
|                                                                                     |                     | MGOe    | 1.10                                                                                                                                | 1.50       | 2.08       | 2.27       |
| 密度 Density                                                                          | ρ                   | g/cm³   | 3.05                                                                                                                                | 3.35       | 3.70       | 3.85       |
| 熔融指數 Melt flow rate                                                                 | MFR                 | g/10min | ≥ 70                                                                                                                                | ≥ 60       | ≥ 60       | ≥ 30       |
| 剩磁可逆溫度係數<br>Reversible temp. coefficient of Br                                      | α (Br)              | %/°C    | -0.19                                                                                                                               | -0.19      | -0.19      | -0.19      |
| 拉伸強度 Tensile Strength                                                               |                     | MPa     | 85                                                                                                                                  | 85         | 85         | 80         |
| 彎曲強度 Flexural strength                                                              |                     | MPa     | 160                                                                                                                                 | 160        | 160        | 145        |
| 衝擊強度 Impact strength                                                                |                     | kJ/m²   | 50                                                                                                                                  | 40         | 20         | 15         |
| 收縮率 Molded shrinking rate                                                           |                     | %       | 0.7                                                                                                                                 | 0.4        | 0.4        | 0.3        |
| >> PA6&PA12系列: 熔融指數測試條件 溫度270攝氏度, 負重 10公斤。<br>>> PPS系列: 熔融指數測試條件 溫度330攝氏度, 負重 10公斤。 |                     |         | PA6 & PA12 Series: MFR test condition Temperature 270°C, Load 10kg.<br>PPS Series: MFR test condition Temperature 330°C, Load 10kg. |            |            |            |

室溫退磁曲綫 Demagnetization Curves at RT



產品性能 Properties of Products

| FEOLET-B12 | FEOLET-B16 | FEOLET-B19 | FEOLET-B20 | FEOLET-B22 | FEOLET-14R | FEOLET-16R |
|------------|------------|------------|------------|------------|------------|------------|
| PA12       |            |            |            |            | PPS        |            |
| 227        | 258        | 283        | 294        | 306        | 250        | 268        |
| 2270       | 2580       | 2830       | 2940       | 3060       | 2500       | 2680       |
| 171        | 193        | 205        | 203        | 209        | 179        | 177        |
| 2150       | 2420       | 2570       | 2550       | 2620       | 2250       | 2226       |
| 279        | 255        | 255        | 247        | 253        | 247        | 218        |
| 3500       | 3200       | 3200       | 3100       | 3180       | 3100       | 2736       |
| 10.0       | 13.1       | 15.5       | 16.7       | 18.0       | 12.1       | 13.7       |
| 1.26       | 1.64       | 1.95       | 2.10       | 2.26       | 1.52       | 1.72       |
| 3.10       | 3.30       | 3.60       | 3.70       | 3.80       | 3.40       | 3.60       |
| ≥ 100      | ≥ 70       | ≥ 70       | ≥ 70       | ≥ 40       | ≥ 100      | ≥ 70       |
| -0.19      | -0.19      | -0.19      | -0.19      | -0.19      | -0.19      | -0.19      |
| 60         | 60         | 55         | 50         | 50         | 55         | 50         |
| 110        | 110        | 110        | 90         | 90         | 110        | 100        |
| 30         | 25         | 20         | 17         | 13         | 9          | 8          |
| 0.7        | 0.6        | 0.5        | 0.4        | 0.4        | 0.4        | 0.4        |



# 多元化產品

## Related Products

以日本專業充磁治具製作廠家為支持，我們可以向您提供專業的技術服務，設計製作質優高效的充磁夾具，使磁體達到最佳的使用性能。另外我們也設計製作各種高效、操作簡便的測定夾具用於磁體的檢測。

Supported by Japanese professional manufacturer of magnetizing jigs, we can extend technical service to our customers. Magnetizing jigs are designed and made to optimize the performance of magnets. Efficient and easily operated testing jigs are also available.

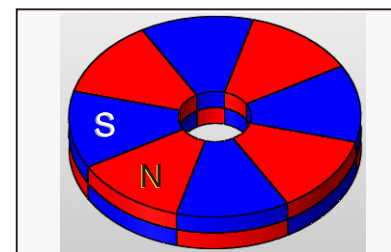


## 多元化產品 Related Products

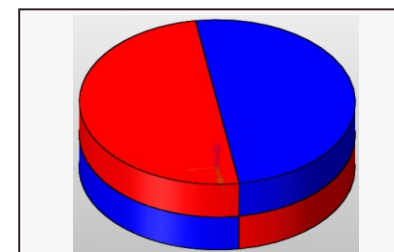
### ● 充磁技術 Technique of magnetization

#### 各類充磁方式3D示意 3D sketch of various magnetization methods

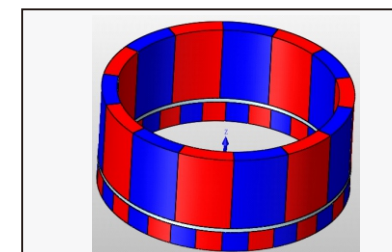
##### ● 平面8極充磁



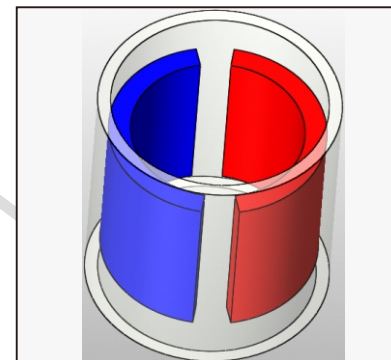
##### ● 平面2極充磁



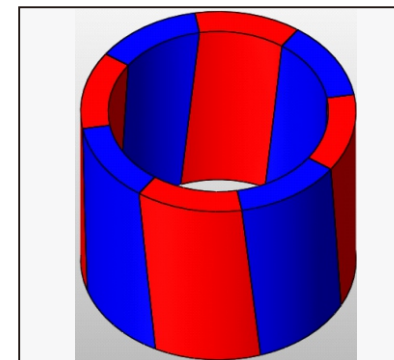
##### ● 徑向和端面一體充磁



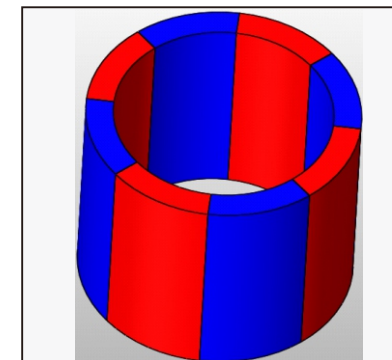
##### ● 雙瓦內徑2極充磁



##### ● 外徑8極斜充磁

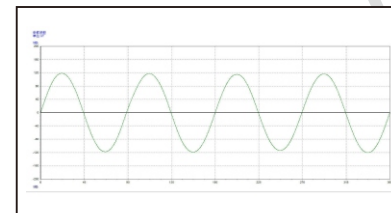


##### ● 外徑8極充磁

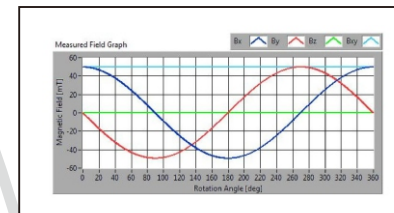


#### 表磁分佈特性 Distribution of surface intensity of magnetic flux

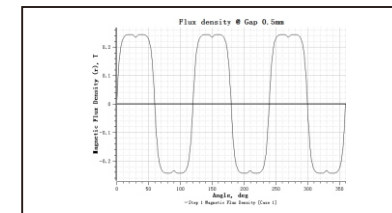
##### ● 平面8極充磁



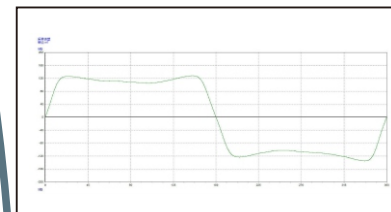
##### ● 平面2極充磁



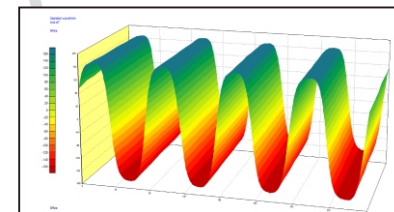
##### ● 產品磁性能仿真計算



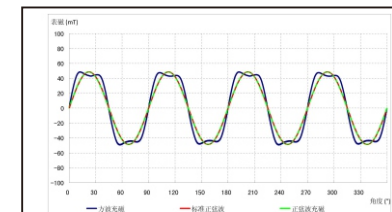
##### ● 雙瓦內徑2極充磁



##### ● 外徑8極斜充磁



##### ● 外徑8極充磁



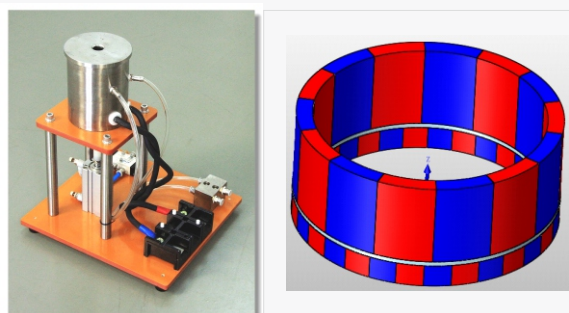
注：  
a) 峰值偏差: Peak value deviation range:  $<3\%[(PEAK_{max}-PEAK_{min})/PEAK_{ave}]$   
b) 極寬偏差: Pole width deviation range:  $\pm 1^\circ$   
c) 最小極寬: Minimum pole width range: 1mm

## 實例 Example

## ● 典型案例 Typical Case

充磁夾具圖片  
Picture of magnetizing jig

徑向和端面一體充磁：  
Integrated magnetization for diameter  
and end surface

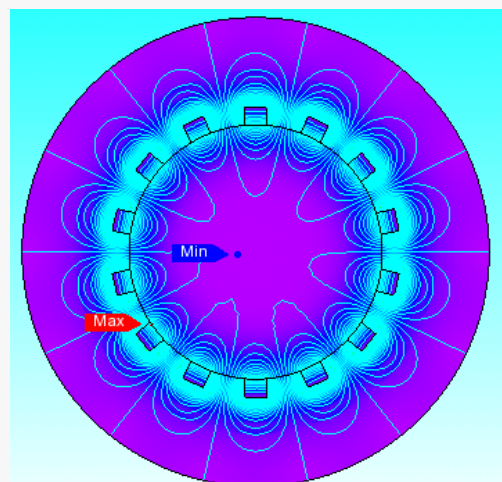
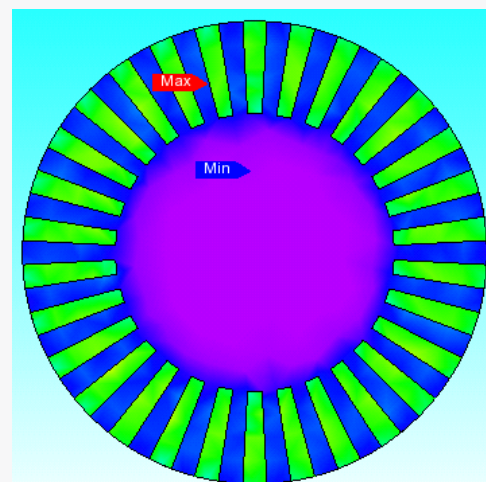
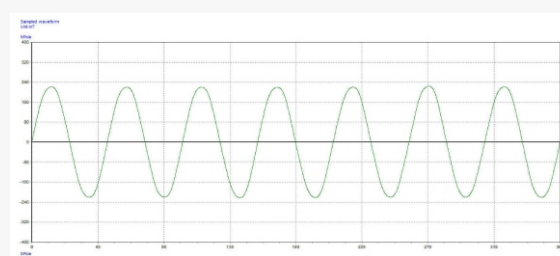
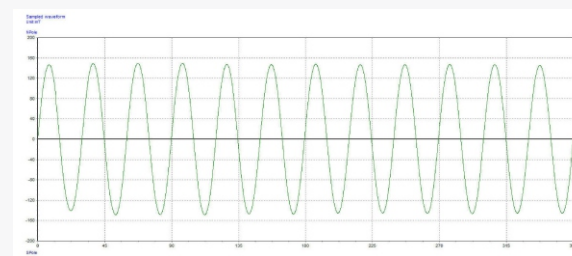
技術參數  
Technical parameter

峰值偏差： $\leq 3\%$   
Peak value deviation range:  $\leq 3\%$   
[(Peakmax-Peakmin)/Peakave]

極寬偏差：  
Pole width deviation range:  $\pm 1^\circ$   
Max(Angle max-Angle ave, Angle ave- Angle min)

最小極寬：  
Min. pole width range: 1mm (D \*  $\pi$ /N)

用途：可用於磁性傳感器  
Application: It can be used for magnetic sensor.

仿真結果-外徑  
Simulation result-OD仿真結果-端面  
Simulation result-End surface磁性波形圖-外徑  
Magnetic waveform-OD磁性波形圖-端面  
Magnetic waveform -End surface

## 注意事项 Warning and caution

## 警告:

- 切勿將磁體接近電子醫療器械或攜帶起搏器等醫療設備的人。
- 切勿吞下磁體。萬一不慎吞下，請立即去醫院治療。
- 請勿將磁體放在兒童可以觸及的地方。

## 注意:

為了不引起人身損傷及磁體運行性能不良，請遵循以下注意事項。

## 設計

- 加熱後，磁體的磁性能會降低。請參照目錄或相關的溫度特性指標，注意在磁體組裝或使用時溫度不要過高。
- 若充磁的磁場強度或方法等不適當，磁體在充磁後，可能會達不到磁體的實際磁性能。相關事宜請事先與本公司協商。
- 在使用或保管磁體時，請避開含有腐蝕性的氣體、導電性高的環境(如含有電解質的水中等)、酸鹼性環境、有機溶劑等。否則會引起磁體的腐蝕及磁性能和機械強度的減弱。關於耐熱性及其他條件，請參考產品目錄或其他資料。相關問題請與本公司協商。

- 磁體硬而脆，因此在用於有振動、衝擊等的場合時，可能有斷裂、脫落等現象發生。如用於此類用途，請在設計時注意，使其即使磁體斷裂也不致脫落。
- 因為馬達是高速運轉體，所以磁體可能破碎。在設計時，請採取必要措施，萬一磁體破碎，碎片也不會飛散出來。
- 磁體與磁軛、電極片等粘結時，請充分確認粘結劑的種類、用量、使用條件、強度及可靠度等。

## 操作

- 充過磁的磁體有很強的磁力，如果使其相互靠近產生衝擊，磁體會破碎並飛散，磁碎片會飛入眼中，推薦使用防護眼鏡。
- 為了保證磁體在空芯線圈中充磁的安全性，請將磁體固定，以免磁體從線圈中急速飛出。
- 請注意充磁後磁石的使用環境，充磁後的磁石會吸引含鐵的碎片或磁部件，裝配後可能需要清洗。

## 保管

- 不要將磁體存放在潮濕的環境中，以免其外觀、物理特性及磁性能發生變化。

## 其他

- 不要將磁體接近軟盤、硬盤驅動器、信用卡、磁帶、借記卡、電視顯像管等。若將磁體接近磁性記錄器等器件，會影響甚至破壞記錄數據。

- 磁體不要接近電子器材，否則會影響設備及控制回路而影響使用。
- 對金屬有敏感反應的人若接近磁體，會使皮膚粗糙、泛紅。若會出現上述反應，請不要接觸磁體。

## WARNING:

- It is dangerous to place a magnet close to a person who wears a pacemaker or any other electrical medical devices.
- Do not swallow magnets. If swallowed, immediately consult doctors.
- Keep magnets out of children's reach.

## CAUTION:

Please observe the followings to avoid injury or magnetic properties deterioration.

## Design

- The magnitude of magnetization drops when heated. Please refer to the temperature characteristics in catalog, and be careful that the magnet can not be overheated when assembling or using.
- If the magnetizing conditions are inadequate, the magnet may not generate designed performance. Please consult us in advance.
- Please avoid using or storing in: corrosive gas, high conductive condition (like in water with electrolyte), hydrogen environments, acid alkaline, or organic solutions. This will cause corrosion of the magnet, deterioration in magnetic properties and mechanical strength. Please refer to the catalog about heat resistance and so on. Please contact us if you anticipate any problems.
- Magnets are not flexible. When vibration or collision are added to magnets, the magnets may chip. In designing the magnets, please consider these characteristics.
- In high speed revolution application, such as motors, the magnet may break. Please take measures to ensure that magnets are properly secured and protected.
- When gluing with other magnets, yokes and pole pieces, please confirm the reliability by thorough checking the type, amount, condition, and strength of the adhesive.

## Handling

- A magnetized magnet has strong power of attraction. Safety glasses are recommended. Strong impact by attraction power may shatter the magnet.
- When magnetizing in an air core coil, please fix the magnet for safety. The magnet may suddenly spring from the coil.
- Please pay attention to the surroundings a magnetized magnet may be used in. It attract debris like iron filings and magnet particles. It may be necessary to wash after assembling.

## Storage

- Avoid storing under humid conditions. The surface conditions, physical properties and magnetic properties may change.

## Others

- Do not bring magnets close to floppy disk, hard disk drive, credit card, magnetic tape, pre-paid card or television tubes. Files or data may be erased or damaged if magnets are placed near magnetic storage media.
- Do not place magnets near electronic devices. It could adversely affect instruments and control circuits.
- People who are allergic to metal might develop a rash if they touch a magnet. Do not handle magnets if these symptoms appear.

# 金屬注射成形產品

## Metal Injection Molding Parts

### 產品一覽 Products Overview



### 設備與設施 Equipments and Facilities



## MIM 產品的特點 MIM Products Features

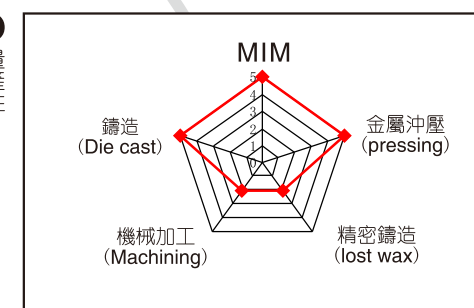
MIM 是將現代塑膠注射成形技術引入粉末冶金領域而形成的一種全新的金屬零部件近淨成形加工技術，是近年來粉末冶金學科和工業領域中發展十分迅猛的一項高新技術。

By introducing modern plastic injection molding technique into powder metallurgy, MIM becomes a new technology for near net forming of metal parts. It is a rapidly growing, high-tech manufacturing process in powder metallurgy and the whole industry.

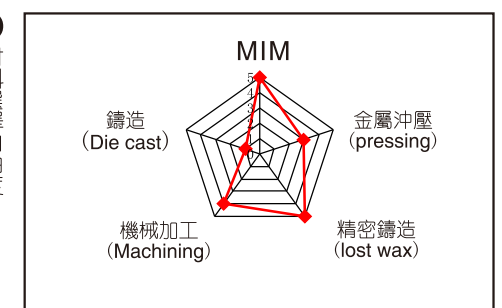
- 零部件幾何形狀的自由度高，能像生產塑膠製品一樣，一次成形生產形狀複雜的金屬零部件。
- MIM 產品密度均勻、光潔度好，表面粗糙度可達到  $Ra0.80 \sim 1.6 \mu m$ ，重量範圍在  $0.1 \sim 200g$ 。尺寸精度高 ( $\pm 0.3\% \sim \pm 0.5\%$ )，一般無需後續加工。
- 適用材料範圍寬，應用領域廣，原材料利用率高，生產自動化程度高，工序簡單，可實現連續大批量生產。
- 產品品質穩定、性能可靠，製品的相對密度可達  $95\% \sim 99\%$ ，可進行滲碳、淬火、回火等熱處理。產品強度、硬度、延伸率等力學性能高，耐磨性好，耐疲勞，組織均勻。
- The shape of MIM parts has high degree of freedom. Metal parts with complex shape can be formed in single step, like the production of plastic items.
- The products have high dimension precision ( $\pm 0.3\% \sim \pm 0.5\%$ ), uniform density (95% ~ 99% of theoretical density), good smoothness (surface roughness of  $Ra0.80 \sim 1.6 \mu m$ ). The unit weight of parts is in the range of 0.1 ~ 200g.
- Widely applicable materials, extensive applications, high yield of raw materials, with high degree of automation MIM can achieve continuous mass production easily.
- MIM parts have stable quality, reliable performance, uniform microstructure and can achieve 95%~99% density ratio. With excellent mechanical properties, including strength, hardness and elongation, MIM products has good resistance to abrasion and fatigue. Post-sinter heat treatment such as carburizing, quenching and tempering is available.

## 與其它加工方法的比較 Process Comparison

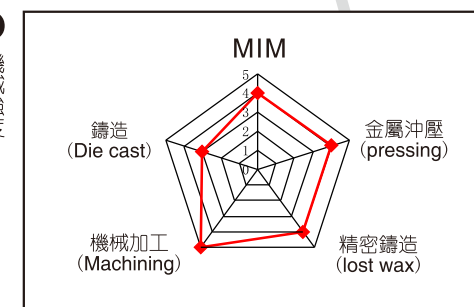
● 量產性  
Mass productivity



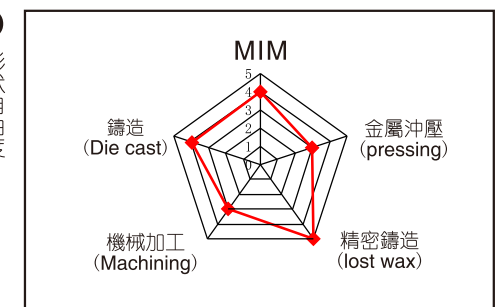
● 材料選擇自由度  
Variety of materials



● 機械強度  
Mechanical strength



● 形狀自由度  
Design freedom

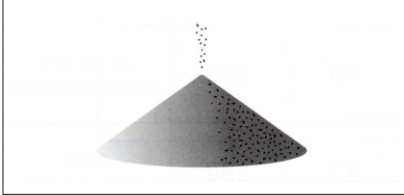
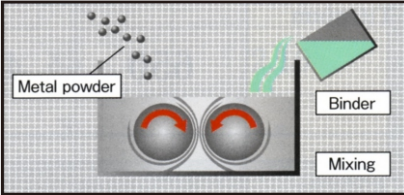
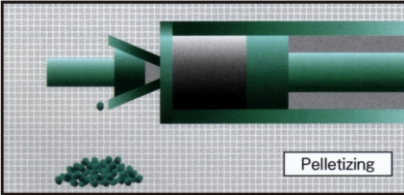
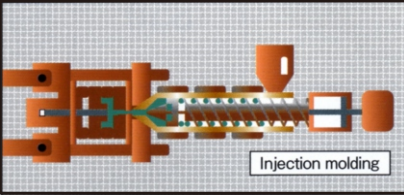


MIM 產品的一般特性 MIM Products Characteristics

|                             |                                                                |              |
|-----------------------------|----------------------------------------------------------------|--------------|
| 尺寸精度<br>Dimension precision | 50~3mm                                                         | ± 0. 5%~0.3% |
|                             | Φ3mm以下<br>Under Φ3mm                                           | ± 0.3%       |
| 表面粗糙度<br>Surface roughness  | 微細粉末（平均粒度5~10μm）<br>Fine powder(mean particle size 5~10μm)     | 0. 5~1.1μm   |
|                             | 極細粉末（平均粒度2~5μm）<br>Super fine powder(mean particle size 2~5μm) | 0.4~0.6μm    |
| 對應尺寸<br>Dimension           | 長度<br>Length                                                   | < 100mm      |
|                             | 厚度<br>Thickness                                                | < 15mm       |
| 重量<br>Weight                | 例如：不銹鋼<br>e.g. Stainless steel                                 | < 100g       |
| 密度<br>Density               | 例如：不銹鋼<br>e.g. Stainless steel                                 | > 95%        |

注：按材料和形狀不同選擇規格範圍  
Note: The range of specification may change according to the material and shape.

產品制造工程介紹 Manufacturing Process of MIM

|                                                                                     |                                                                                     |                                                                                      |
|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|
| 1 原料粉末 (Metal powder )                                                              | 2 混練 (Compounding )                                                                 | 3 造粒 (Pelletizing)                                                                   |
|  |  |  |
| 4 注射 (Injection molding)                                                            | 5 脫脂·燒結 (De-binding/sintering)                                                      | 6 完成 (Finished products)                                                             |
|  |  |  |

磁性材料 Magnetic Alloy



| 材料系列<br>Material series | 最大磁導率<br>Maximum magnetic permeability<br>$\mu_m$ | 矯頑力<br>Coercitivity<br>$H_c$ (A/m) | 磁通密度<br>Magnetic flux density<br>$B_{2000}$ (T) |
|-------------------------|---------------------------------------------------|------------------------------------|-------------------------------------------------|
| Fe-1Si                  | 6760                                              | 80                                 | 1.55                                            |
| Fe-3Si                  | 6390                                              | 60                                 | 1.50                                            |
| Fe-49Co-2V              | 4680                                              | 230                                | 2.00                                            |
| Fe-50Co                 | 5660                                              | 85                                 | 2.10                                            |

不銹鋼材料 Stainless Steel



不銹鋼系列牌號 Stainless Steel Series Code

| 材料系列<br>Material series | 抗拉強度 (MPa)<br>Tensile strength | 延伸率(%)<br>Elongation | 硬度 (Hv)<br>Hardness | 備考<br>Note                                            |
|-------------------------|--------------------------------|----------------------|---------------------|-------------------------------------------------------|
| SUS304L                 | 530                            | 65                   | 130                 | 通用<br>General purpose                                 |
| SUS316L                 | 530                            | 63                   | 130                 | 高耐腐蝕<br>High corrosion-resistance                     |
| SUS317L                 | 510                            | 64                   | 130                 | 比SUS316耐腐蝕性更高<br>Higher corrosion-resistance than 316 |
| SUS420J2                | 810                            | 13                   | 500                 | 高硬度<br>High hardness                                  |
| SUS440C                 | -                              | -                    | 700                 | 硬度最高<br>The highest hardness                          |
| SUS630                  | 1140                           | 4                    | 400                 | 高强度<br>High strength                                  |