YSS Plastic Mold Steels “HI-PM” series are increasing in popularity in compliance with advanced plastic molding technology. “HI-PM” series are fulfilling demands of the plastic industry for molds that provide crepe-and mirror-finishability and mold durability for corrosive gas generating and reinforced resins.
# Mold Material and Application

<table>
<thead>
<tr>
<th>Group</th>
<th>Hardness Employed (HRC)</th>
<th>Grade</th>
<th>Material Type</th>
<th>Application Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prehardened</td>
<td>29～33</td>
<td>HI-PM7</td>
<td>P20 improved</td>
<td>Mold required good weldability and machinability (Autoparts, Home electronics, House equipment)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HI-PM38</td>
<td>420 improved</td>
<td>Flame retardant resin, Transparent parts, Rubber</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HI-PM77</td>
<td>420 improved &amp; resulphurized</td>
<td>Corrosion resistant mold bases, Rubber mold</td>
</tr>
<tr>
<td></td>
<td>(Round Bar) 38～42 (Flat Bar) 33～37</td>
<td>PSL</td>
<td>630 improved</td>
<td>Mold for polyvinyl chloride, Frothy resin, Rubber</td>
</tr>
<tr>
<td></td>
<td>37～42</td>
<td>CENA1</td>
<td>Cr contained NiAl precipitation grade</td>
<td>Rust resistant mold with sensitive surface as mirror polishing, creping, EDM, Weldless Mold</td>
</tr>
<tr>
<td></td>
<td>37～41</td>
<td>HI-PM MAGIC</td>
<td>P20 improved</td>
<td>General Mass-Production Mold (Autoparts,OA equipment, Home Electronics)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HI-PM PRO</td>
<td>P21 improved</td>
<td>Parts associated with automobile headlamp production, Exterior of cellular phone</td>
</tr>
<tr>
<td></td>
<td>38～42</td>
<td>FDAC</td>
<td>H13 improved &amp; resulphurized</td>
<td>Engineering resin, Slide core</td>
</tr>
<tr>
<td>For Quench and Temper</td>
<td>50～55</td>
<td>HI-PM38</td>
<td>420 improved</td>
<td>Mold for Anti-corrosion / Mirror polish (Casette, Medical instruments, Food container, etc)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HI-PM38S</td>
<td>420 improved</td>
<td>Mold for super mirror polish (Optical disc / Lens)</td>
</tr>
<tr>
<td></td>
<td>56～62</td>
<td>HI-PM31</td>
<td>D2 improved</td>
<td>Wear resistant mold for engineering resin (Gear, Connector, IC)</td>
</tr>
<tr>
<td></td>
<td></td>
<td>HAP5R</td>
<td>P/M HSS</td>
<td>Mold required high toughness and high hardness (Core pin, Thin wall)</td>
</tr>
<tr>
<td></td>
<td>60～63</td>
<td>ZCD-M</td>
<td>D2 improved</td>
<td>IC mold</td>
</tr>
<tr>
<td></td>
<td>60～65</td>
<td>ZDP4</td>
<td>P/M Cold Die Steel</td>
<td>Reinforced and flame retardant engineering resin, IC mold, Slide parts, Cutter required exceptional wear resistance</td>
</tr>
<tr>
<td>For Aging</td>
<td>40～45</td>
<td>HI-PM75</td>
<td>High hardness, non-magnetic, resulphurized</td>
<td>Molding in magnetic field (Plastic magnet)</td>
</tr>
<tr>
<td></td>
<td>52～57</td>
<td>YAG</td>
<td>Maraging Steel</td>
<td>Mold required exceptional toughness (Core pin, Thin wall), Super mirror polish (Optical lense)</td>
</tr>
</tbody>
</table>
# Resin Types and Grade Selection

<table>
<thead>
<tr>
<th>Resin</th>
<th>Required Properties for Mold</th>
<th>Required Life and Grade Recommended</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>SHORT &lt;100,000</td>
</tr>
<tr>
<td>General</td>
<td>Machinability</td>
<td>HI-PM7</td>
</tr>
<tr>
<td>Engineering Resin</td>
<td>Wear Resistivity</td>
<td>HI-PM7</td>
</tr>
<tr>
<td>Reinforced</td>
<td>High Wear Resistivity</td>
<td>FDAC</td>
</tr>
<tr>
<td>Flame Retardant</td>
<td>Corrosion Resistivity</td>
<td>HI-PM38</td>
</tr>
<tr>
<td>Transparent</td>
<td>Mirror Polishability</td>
<td>CENA1</td>
</tr>
<tr>
<td>General</td>
<td>Wear Resistivity</td>
<td>HI-PM MAGIC</td>
</tr>
<tr>
<td>Reinforced</td>
<td>High Wear Resistivity</td>
<td>HI-PM MAGIC</td>
</tr>
</tbody>
</table>

**General Resin:** PS, PE, PP, AS, ABS etc.

**Engineering Resin:** PC, PPE, PA, POM, PBT, PET etc.

**Advanced Engineering Resin:** PPS, PI, PES, PEEK etc.

---

## Properties Comparison Table

<table>
<thead>
<tr>
<th>Material</th>
<th>Machinability</th>
<th>Dimensional change by heat treatment</th>
<th>EDM/Creping texture</th>
<th>Mirror polishability</th>
<th>Weldability</th>
<th>Rust resistance</th>
<th>Wear resistance</th>
<th>Toughness</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI-PM7</td>
<td>A</td>
<td>–</td>
<td>C</td>
<td>C</td>
<td>A</td>
<td>D</td>
<td>D</td>
<td>B</td>
<td>E</td>
</tr>
<tr>
<td>HI-PM77</td>
<td>B</td>
<td>–</td>
<td>D</td>
<td>D</td>
<td>C</td>
<td>B</td>
<td>D</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>PSL</td>
<td>D</td>
<td>–</td>
<td>B</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>D</td>
<td>B</td>
<td>D</td>
</tr>
<tr>
<td>CENA1</td>
<td>C</td>
<td>–</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>C</td>
<td>D</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>HI-PM MAGIC</td>
<td>B</td>
<td>–</td>
<td>B</td>
<td>C</td>
<td>A</td>
<td>D</td>
<td>D</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>HI-PM PRO</td>
<td>B</td>
<td>–</td>
<td>A</td>
<td>B</td>
<td>B</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>C</td>
</tr>
<tr>
<td>FDAC</td>
<td>C</td>
<td>–</td>
<td>D</td>
<td>D</td>
<td>C</td>
<td>D</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td>HI-PM38</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>D</td>
<td>D</td>
<td>B</td>
<td>D</td>
</tr>
<tr>
<td>HI-PM38S</td>
<td>C</td>
<td>A</td>
<td>A</td>
<td>A</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>C</td>
<td>E</td>
</tr>
<tr>
<td>HI-PM31</td>
<td>C</td>
<td>A</td>
<td>B</td>
<td>D</td>
<td>C</td>
<td>B</td>
<td>C</td>
<td>C</td>
<td>D</td>
</tr>
<tr>
<td>HAP5R</td>
<td>C</td>
<td>C</td>
<td>A</td>
<td>B</td>
<td>D</td>
<td>E</td>
<td>B</td>
<td>B</td>
<td>E</td>
</tr>
<tr>
<td>ZCD-M</td>
<td>D</td>
<td>C</td>
<td>A</td>
<td>D</td>
<td>E</td>
<td>C</td>
<td>B</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>ZDP4</td>
<td>E</td>
<td>D</td>
<td>B</td>
<td>E</td>
<td>A</td>
<td>A</td>
<td>E</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>HI-PM75</td>
<td>E</td>
<td>B</td>
<td>D</td>
<td>E</td>
<td>B</td>
<td>C</td>
<td>C</td>
<td>E</td>
<td>C</td>
</tr>
<tr>
<td>YAG</td>
<td>D</td>
<td>B</td>
<td>A</td>
<td>A</td>
<td>D</td>
<td>C</td>
<td>A</td>
<td>E</td>
<td>C</td>
</tr>
<tr>
<td>S55C</td>
<td>A</td>
<td>–</td>
<td>C</td>
<td>E</td>
<td>C</td>
<td>E</td>
<td>E</td>
<td>C</td>
<td>A</td>
</tr>
<tr>
<td>SCM440</td>
<td>C</td>
<td>–</td>
<td>C</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>D</td>
<td>C</td>
<td>B</td>
</tr>
</tbody>
</table>

**Ratings:** A--Best  C--Ordinary  D,E--Poor

**Remarks:** Please refer above as general concept.
Properties Comparison

Polishing Property
(Schematic Diagram)

Machinability
Drilling
Tool: SKH51 φ10
Feed: 0.15mm/rev
Depth: 30mm
Dry

Corrosion Resistance
(5%Sulfuric Acid Solution)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Hardness (HRC)</th>
<th>Cutting Speed (Tool Life : Cutting Length 1m)</th>
<th>Weight Loss by Corrosion (mg/cm²·h)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PSL</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>HI-PM75</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>HI-PM38</td>
<td>2</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>HI-PM38S</td>
<td>3</td>
<td>20</td>
<td>20</td>
</tr>
<tr>
<td>HI-PM31</td>
<td>4</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>HI-PM75</td>
<td>5</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>
# Properties Comparison

## Wear Resistance

**Ohgoshi Wear Test**  
Work Material: SCM415  
Load: 67N  
Total Friction Length: 400m  
Friction Speed: 0.78m/sec

<table>
<thead>
<tr>
<th>Grade</th>
<th>Hardness (HRC)</th>
<th>Wear Ratio (mm³/mm²×10⁻⁷)</th>
<th>Better</th>
</tr>
</thead>
<tbody>
<tr>
<td>SKD11</td>
<td>60</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HI-PM31</td>
<td>59</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZDP4</td>
<td>65</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SUS440C</td>
<td>57</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ZCD-M</td>
<td>63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SKH51</td>
<td>63</td>
<td></td>
<td></td>
</tr>
<tr>
<td>HAP40</td>
<td>67</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Mechanical Properties

<table>
<thead>
<tr>
<th>Grade</th>
<th>Hardness (HRC)</th>
<th>Tensile Strength (N/mm²)</th>
<th>0.2% Yield Strength (N/mm²)</th>
<th>Elongation (%)</th>
<th>Reduction of Area (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>HI-PM7</td>
<td>32</td>
<td>975</td>
<td>855</td>
<td>20</td>
<td>55</td>
</tr>
<tr>
<td>HI-PM38</td>
<td>52</td>
<td>1,910</td>
<td>1,620</td>
<td>13</td>
<td>35</td>
</tr>
<tr>
<td>HI-PM77</td>
<td>32</td>
<td>990</td>
<td>845</td>
<td>16</td>
<td>41</td>
</tr>
<tr>
<td>PSL</td>
<td>39</td>
<td>1,170</td>
<td>1,100</td>
<td>11</td>
<td>34</td>
</tr>
<tr>
<td>CENA1</td>
<td>40</td>
<td>1,225</td>
<td>1,150</td>
<td>15</td>
<td>50</td>
</tr>
<tr>
<td>HI-PM MAGIC</td>
<td>40</td>
<td>1,200</td>
<td>1,020</td>
<td>18</td>
<td>45</td>
</tr>
<tr>
<td>HI-PM PRO</td>
<td>40</td>
<td>1,200</td>
<td>1,020</td>
<td>17</td>
<td>45</td>
</tr>
<tr>
<td>HI-PM75</td>
<td>42</td>
<td>1,305</td>
<td>1,110</td>
<td>11</td>
<td>28</td>
</tr>
<tr>
<td>YAG</td>
<td>53</td>
<td>2,010</td>
<td>1,910</td>
<td>10</td>
<td>48</td>
</tr>
</tbody>
</table>

## Physical Properties

<table>
<thead>
<tr>
<th>Grade</th>
<th>Thermal Expansion Coef. (×10⁻⁶/°C)</th>
<th>Thermal Conductivity (W/m-K)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>100°C</td>
<td>200°C</td>
</tr>
<tr>
<td>HI-PM7</td>
<td>11.6</td>
<td>12.2</td>
</tr>
<tr>
<td>HI-PM38</td>
<td>10.4</td>
<td>11.1</td>
</tr>
<tr>
<td>HI-PM77</td>
<td>10.1</td>
<td>10.7</td>
</tr>
<tr>
<td>PSL</td>
<td>10.6</td>
<td>11.1</td>
</tr>
<tr>
<td>CENA1</td>
<td>10.8</td>
<td>11.5</td>
</tr>
<tr>
<td>HI-PM MAGIC</td>
<td>11.5</td>
<td>12.3</td>
</tr>
<tr>
<td>HI-PM PRO</td>
<td>12.7</td>
<td>13.0</td>
</tr>
<tr>
<td>HI-PM31</td>
<td>12.4</td>
<td>13.1</td>
</tr>
<tr>
<td>ZCD-M</td>
<td>10.5</td>
<td>10.8</td>
</tr>
<tr>
<td>HI-PM75</td>
<td>16.1</td>
<td>17.2</td>
</tr>
<tr>
<td>YAG</td>
<td>--</td>
<td>10.8</td>
</tr>
</tbody>
</table>
40HRC Prehardened Grade

**HI-PM MAGIC**

Prehardened: 37~41HRC
Advanced Plastic Mold Steel for general purposes

HI-PM MAGIC is a newly developed grade which has both high durability and excellent processability. Easy weldability will make setup of the new products of home electronics, OA equipments or Auto parts smoother.

### Features
- No heat treatment is necessary (37~41HRC)
- Good and stable polishability
- Steady machinability. Fits for high-speed high feed cutting
- Higher toughness compared with conventional 40HRC grades
- Easy Weldability
- Good EDM finishability
- Excellent nitriding properties
- Satisfying Cost Performance

### Application
- General resin products for home electronics, OA, Auto and so on.

### Efficiency

#### Mirror polishability

It has steady mirror polishability and supports grit size #5000 polish.

Differential interference figure comparison of #5000 mirror polished surface (2 x 2 sequential photographs)

Comparison of 2mmU notch Charpy impact values (example of measurement by our company)
40HRC Prehardened Grade

**HI-PM MAGIC**
Prehardened: 37～41HRC
Advanced Plastic Mold Steel for general purposes

### Efficiency

**Electric Discharge Machinability**
Comparatively uniform electric discharge machined surface can be gained, as well as is relatively soft surface, so post-processing is easy.

![Comparison of electric discharge machined surface](image)

**Crepability**
It has good crepability.

![Example of precise creping](image)

**Nitriding Property**
It has good nitriding properties.

![Nitriding property graph](image)

### Machinability
It has excellent machinability, especially under conditions with higher ejection volume of cutting chips (high efficiency), such as high feed processing.

<table>
<thead>
<tr>
<th>Cutting Volume (cm³/min)</th>
<th>Example of processing method (Tool)</th>
<th>Steel Grade</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td><strong>HI-PM MAGIC</strong></td>
</tr>
<tr>
<td>&gt;10</td>
<td>Face milling cutter, high feed radius mill</td>
<td>A</td>
</tr>
<tr>
<td>1–10</td>
<td>Solid high feed end mill</td>
<td>A</td>
</tr>
<tr>
<td>0.1–1</td>
<td>High-speed steel drill, solid ball end mill</td>
<td>B</td>
</tr>
<tr>
<td>0.01–0.1</td>
<td>High-speed steel drill, small end mill</td>
<td>B</td>
</tr>
</tbody>
</table>

- **High feed radius mill**
  In comparison with the conventional steel, it is possible to achieve significant improvement in cutting efficiency.
40HRC Prehardened Grade

**CENA1**

Prehardened: 37～41HRC
Advanced Plastic Mold Steel for general purposes

CENA1 is new concept grade breaking through with rust resistivity and excellent machinability. CENA1 has exceptional high purity and suit for critical surface finish.

**Features**
- No heat treatment is necessary. Uniform hardness distribution. (37～42HRC)
- Higher rust resistivity compared with P21 type grade.
- Excellent mirror polishability, crepe- and EDM finishability.
- Good weldability with least hardness elevation.
- Good nitrind hardenability and can be used for wear resisting application.

**Application**
- Most Suitable for Weldless Molding
- Countermeasure against corrosion by gas generated from resin.
- Other Critical Surface Finish Molds. Engineering resin products

**HI-PM PRO**

Prehardened: 37～41HRC
Precipitation Hardening, Rust-Resisting Grade for Precise Mold

HI-PM PRO is the steel for plastic molds which precise pursues consistency in production to meet requirement for elaborately designed products.

**Features**
- "Hardness" (37 to 41HRC) which is suitable for mass production of resin products by precision molding.
- "Excellent machinability for high quality appearance" supports excellent mirror polishability, creping, EDM surface (thanks to the special melting method)
- "Toughness and machinability" supports stable mold making and productivity.

**Application**
- The parts associated with automobile headlight production
- The exterior of cellular phone

**TV Glossy Frame (Weldless Molding)**

**Non-glare Treatment Sample**

**Creening Sample**

**Charpy impact value**

Comparison of 2mmU notch Charpy impact values
32HRC Prehardened Grade

HI-PM7

Prehardened: 29～33HRC
For Medium and Large Mold
for General Application

HI-PM7 is plastic mold steel prehardened to 29～33HRC fitted for medium and large size mold, having good machinability and weldability. In addition, it has good mirror polishability and EDMachinability to make itself one of the best steel in this class grade.

Features

● Uniform hardness distribution even in large crosssection. (29-33HRC)
● Machinability is better than P20 or free machining steel.
● Excellent weldability with least hardness elevation.
● Good mirror polishability.
● Less streak texture and least hardness elevation on EDM surface makes finishing easier.
● Excellent toughness.
● Excellent nitriding property.

Application

● Auto parts: Headlamp, Tail lamp, Inner panel etc.
● Home electronics, House equipment: TV cabinet, Air conditioner housing etc.
● Others large daily goods, Large container, Pipe, Rubber

Machinability Comparison

Endmill: Co-HSS¢3
V=22.5m/min
f=0.0552mm/Blade
a=2x×10H
Wet

y-groove Weld Crack Test
JIS Z 3158
TIG Welding
No pre-heating / No post-heating
Stainless Steel for Quench and Temper

**HI-PM38**

Prehardened: 29~33HRC
Hardenable to: 50~55HRC
For Anti-Corrosion and Mirror Polish Mold

HI-PM38 is Mo contained 13Cr martensitic stainless steel prehardened to 29-33HRC, manufactured by consumable electrode remelting method, further hardenable to 50-55HRC. It is fitted for molds which require corrosion resistance and superb mirror polishability. In addition, it suits for precise heat treatment. Excellent corrosion resistance also makes mold storage easier.

**Features**

- Excellent mirror polishability
- Better corrosion-resistivity than 420.
- Chromium plating is not necessary.
- Least heat treatment deformation, best fitted for precise mold.
- As HI-PM38 is supplied as prehardened condition, it can be used without further heat treatment also.

**Application**

- Transparent items: Lens, Container for cosmetics, etc.
- Flame retardant resin products: Home electronics, OA equipment
- For saving plating: Food container, Medical instruments

**Heat Treatment**

- Quenching: 1,000 ~ 1,050°C Air Cooling
- Tempering: 200 ~ 500°C Air Cooling

---

**HI-PM38S**

Prehardened: 29~33HRC
Hardenable to: 50~55HRC
For Super Mirror Polish Mold

**Features**

- Superior mirror polishability to below 0.01μm surface roughness.
- Other features are same as HI-PM38.
- CD, DVD, MO, and optical lens

---

**Heat Treatment Properties of HI-PM38**

- Dimensional Distortion (%)
- Width
- Length
- Hardness (HRC)

**Purity of HI-PM38S**

- Normalized Inclusion Quantity (Index Number)
- SUS420J2
- HI-PM38
- HI-PM38S
Prehardened Stainless Grade

**PSL**
Prehardened: 33~37HRC (Flat bar)
38~42HRC (Round bar)
For Higher Grade Anti-Corrosion Mold

PSL is precipitation hardening stainless steel which shows superior corrosion resistance as used for corrosive gas yielding resins or resins with flame retardant additives without plating.

**Features**
- Best corrosion resistance among plastic mold steels. Plating is not needed.
- Least hardness elevation on EDM or welded surface and easier finishing jobs.

**Application**
- Polyvinyl chloride: Pipe fittings, Pipe, Sash etc.
- Resins with flame retardant additives
- Precision mold for rubber

**HI-PM77**
Prehardened: 29~33HRC
Free Machining Martensitic
Stainless Grade for Mold Base

**Features**
- Good corrosion resistance and well fitted for rust protection of water cooling holes or surface of mold base.
- Excellent machinability
- Prehardened and good mechanical properties

**Application**
- Holder for compact disc mold or lense mold.
- Holder for food or medical container mold and precise engineering resin mold.
- Mold for rubber
- Anti-corrosive support tools
High Wear Resistance Grade

**HI-PM31**

Hardenable to: 55~60HRC  
High Wear Resistant Grade for Mass Production

HI-PM31 is wear resistant plastic mold steel with fine carbide uniformly distributed by means of appropriate alloy design and consumable electrode remelting process. Least heat treatment distortion, it suits for precise heat treatment.

### Features

- Wear resistance is as high as JIS SKD11.
- Much better machinability and grindability than JIS SKD11.
- Least heat treatment deformation, best fitted for precise mold.
- Good mirror polishability crepe and EDM finishability
- High hardness and toughness, enough against chipping or breakage

### Application

- Engineering resin products and thermosetting resin products
- Precise mold: IC mold, Connector, Watch parts, Camera parts

### Heat Treatment

- **Quenching**: 1,000 ~ 1,050°C Air Cooling
- **Tempering**: 200 ~ 550°C Air Cooling

**Heat Treatment Properties of HI-PM31**

- **Size**: 16T×46W×60L
- **Quench**: 1,030°C(VQ)
- **Nitrided Cooling**
Aging Grade

YAG

Hardenable to: 52~57HRC
Super High Toughness
Maraging Steel

As YAG is delivered as solution heat treated condition, you are advised to conduct aging at 480~520°C in order to get hardness between 52~57HRC after engraving cavity.

Features

- Superior toughness and mechanical properties under high hardness and best fitted against breakage
- Super mirror polishability
- Hardness of 55HRC is obtainable by aging at 500°C with least distortion

Application

- Optical lense
- Thin core pin
- Ejector pin, either of small dia meter or of long length

HI-PM75

Hardenable to: 40~45HRC
Non-Magnetic High Hardness
Free Machining Plastic Mold Steel

Features

- Permeability(μ) is 1.01, equally non-magnetic as 304
- 40~45HRC is obtainable by aging of 700°C×5h and has higher wear resistance.
- Good nitriding properties

Remarks:
Slow molding recommended as it is easily hardened by machining.

Application

- Plastic magnet
- Wear resistant, non-magnetic supportive tools

Relationship between Hardness and Notch Strength

Ejector pin

Optical Lense

YAG

SKD61

SCM440

Plastic Magnet
Higher Grade Polishing Method of Plastic Mold

Polish procedure Example

- Polish by oil grinding stone (use kerosene)  
  -180→#240→#320→#400→#600→#800
- Polish by oil sand paper (use kerosene)  
  -#600→#800→#1000→#1200→#1500
- Finish Polishing by diamond compound (use felt cloth)  
  -#1800→#3000→#8000→#14000
  \( (9\mu m) \) \( (6\mu m) \) \( (3\mu m) \) \( (1\mu m) \)

Important points of polishing

1. Each procedure is to be strictly kept.
2. When changing from one number to another, check if there are remained scrach by changing polishing direction. (move 45-90 degrees)
3. When changing numbers, wash and remove last polishing grains completely.
4. Polishing by diamond compound needs to be done in short times. Excessive polish can produce pinholes or orange peel.
5. To avoid alumina and chromium oxide as the polish capabilities are lower than diamond.
6. During long interruption, the object must be protected from the rust.

Remarks:

A. For superior polishing use diamond compound. Don’t use alumina nor chromium-oxide compound.

B. Load for polishing should be kept lowest possible.
C. Foregoing polish should be done prudently.
D. Rust proof measures must be taken in any interruption of jobs.
**Attentive points**

1. **Preparations before welding**

   A. Form of location to get welded should be made smooth as Figure 1.
   B. Cracks and treated surface (nitrided or plated) must be eliminated.
   C. Oil, dust, moisture and scale must be removed thoroughly.

![Figure 1. Standing shapes for build up welding](image)

2. **Welding rod**

   A. Welding rod of similar composition as mold is to be used so that welding may not bring about unevenness of mirror finish or creping surface. When the mold is made from HI-PM MAGIC, use welding rod made from HI-PM MAGIC-W. Likewise, in case for TIG welding there are T-HTM-31 and T-HTM38 in the market for welding for mold made from HI-PM31 and HI-PM38.

   B. In case of using coated electrode, welding rod should be dried by heating to 250-300°C before using.

   C. For cavity welding, TIG welding should be applied.

   (TIG : Tungsten Inert Gas)

3. **Welding**

   A. Figure 2 shows example of actual welding jobs of representative grades.

   B. Tempering should be conducted soon after welding in case of prehardened steel or hardened and tempered steel according to Figure 2. Tempering is effective to protect mold from crack and to stabilize mirror finish and creped surface by having uniform hardness and structure.

<table>
<thead>
<tr>
<th>Mold Steel Grade</th>
<th>Welding Method</th>
<th>Welding Rod Type</th>
<th>Condition</th>
<th>Heat Cycle</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>HI-PM MAGIC</strong></td>
<td>TIG</td>
<td>HI-PM MAGIC-W</td>
<td>TIG Welding</td>
<td>Pre-heat 150<del>300°C, Welding Post-heat 150</del>300°C, (Stress relieving for correcting deformations and precise creping)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Current: 2.4φ 80<del>160A, 3.2φ 110</del>200A, Flow Rate 10~15ℓ/min</td>
<td>450~550°C, Air Cooling</td>
</tr>
<tr>
<td><strong>HI-PM7</strong></td>
<td>TIG</td>
<td>HI-PM7-W</td>
<td>Shielded Metal Ark Welding</td>
<td>Pre-heat 100<del>150°C, Welding Post-heat 200</del>300°C, Cool Slowly</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Shielded Metal Ark</td>
<td>Current: 3.2φ 90<del>120A, 4.0φ 130</del>160A</td>
<td>Tempering 500~600°C, 1hr/25mm, Air Cooling</td>
</tr>
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<td></td>
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<td>TH-50</td>
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</tbody>
</table>

![Figure 2. Welding procedure](image)