Features

1. Finely distributed spherical carbides
2. Excellent quenching nature
3. Excellent softening resistance under high temperature
4. Excellent heat impact and fatigue resistance
5. Excellent erosion resistance to molten metal

Applications

<table>
<thead>
<tr>
<th>Application</th>
<th>Hardness</th>
<th>Application</th>
<th>Hardness</th>
</tr>
</thead>
<tbody>
<tr>
<td>A1, Zn, die caster mold</td>
<td>41~48HRC</td>
<td>Hot work shearblade</td>
<td>35~45HRC</td>
</tr>
<tr>
<td>Mold's accessories (Plunger sleeve, chip etc.)</td>
<td>45~50HRC</td>
<td>Hot work press mold</td>
<td>42~50HRC</td>
</tr>
<tr>
<td>Hot work pressing die</td>
<td>43~48HRC</td>
<td>Same as other</td>
<td>_____</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Hot work equipment</td>
<td></td>
</tr>
</tbody>
</table>
### Chemical Composition

<table>
<thead>
<tr>
<th>Daido</th>
<th>JIS Equivalent</th>
<th>C</th>
<th>Si</th>
<th>Mn</th>
<th>Cr</th>
<th>Mo</th>
<th>V</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHA1</td>
<td>SKD61</td>
<td>0.32-0.42</td>
<td>0.80-0.120</td>
<td>≤ 0.50</td>
<td>4.50-5.50</td>
<td>1.00-1.50</td>
<td>0.80-1.20</td>
</tr>
</tbody>
</table>

### Heat Treatment

<table>
<thead>
<tr>
<th>Forging Temperature (°C)</th>
<th>Condition for heat treatment °C</th>
<th>Hardness</th>
<th>Transformation Temp °C</th>
</tr>
</thead>
<tbody>
<tr>
<td>1100–900</td>
<td>Slow cooling, Oil cooling</td>
<td>≤ 229 HB</td>
<td>847–918, 769–725, 320</td>
</tr>
<tr>
<td>820–870</td>
<td>Air cooling</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1000–1050</td>
<td>Air cooling</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- **Annealing**: 1100–900 °C, Slow cooling, Oil cooling
- **Hardening**: 1000–1050 °C, Air cooling
- **Tempering**: 550–650 °C, Air cooling

### Quenching Hardness

- **Graph**: Relationship between quenching temperature (°C) and hardness (HRC)
  - Oil cooling
  - Air cooling

### Relationship Between Quenching Temperature and Toughness

- **Graph**: Charpy impact value (J/cm²) vs. quenching temperature (°C)
  - Holding time: 10min
  - Tempering: 600°C x 1hr

### Tempering Hardness

- **Graph**: Hardness (HRC) vs. tempering temperature (°C) (1hr air cooling)
  - Air cooling: 980°C, 1020°C, 1050°C

### Resistance Against Softening by Tempering

- **Graph**: Hardness (HRC) vs. tempering temperature (°C) (580°C x 1hr heating)
  - Initial hardness: 51±1 HRC
  - Initial hardness: 49±1 HRC
  - Initial hardness: 46±1 HRC
  - Quenching temperature: 1030°C x 30min GC
Quality Characteristics

**Dimensional change by Heat Treatment**

- Specimen: φ25 x 50mm
- H: 1030°C Air cooling

**Nitriding Characteristics**

- Hardness: 47HRC
- Tufftride process: 570°C x 3h

**Tensile Characteristics**

- Tensile strength
- Yield point
- Reduction of area
- Elongation

**Toughness**

- H: 1030°C Air cooling
- T: 635°C Air cooling (Rolling Direction)

**Thermal Conductivity (cal/cm·sec·°C)**

<table>
<thead>
<tr>
<th>Daido Brand</th>
<th>25°C</th>
<th>100°C</th>
<th>200°C</th>
<th>300°C</th>
<th>400°C</th>
<th>500°C</th>
<th>600°C</th>
<th>700°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHA1</td>
<td>0.0569</td>
<td>0.0605</td>
<td>0.0702</td>
<td>0.0707</td>
<td>0.0687</td>
<td>0.0624</td>
<td>0.0712</td>
<td>0.0721</td>
</tr>
</tbody>
</table>

**Coefficient of Thermal Expansion (x 10⁻⁶/°C)**

<table>
<thead>
<tr>
<th>Daido Brand</th>
<th>~100°C</th>
<th>~200°C</th>
<th>~300°C</th>
<th>~400°C</th>
<th>~500°C</th>
<th>~600°C</th>
<th>~700°C</th>
</tr>
</thead>
<tbody>
<tr>
<td>DHA1</td>
<td>10.5</td>
<td>11.4</td>
<td>12.1</td>
<td>12.8</td>
<td>13.3</td>
<td>13.7</td>
<td>13.6</td>
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</tbody>
</table>
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