ALLOY DEVELOPMENT FOR EXTRUDED AUTOMOTIVE ALUMINIUM APPLICATIONS

FOCUS ON CRASH, TEMPERATURE STABILITY AND CORROSION

SAPA EXTRUSIONS TØNDER
OCTOBER 14, 2013
OEM REQUIREMENTS

Dimensions

Corrosion

Alloy and process

Mechanical requirements

Crash / ductility

Temperature stability
ALLOY DEVELOPMENT - BASICS

The diagram illustrates the solubility limits of Mg2Si in different alloys. The X-axis represents Mg (wt%), while the Y-axis represents Si (wt%). The different colors and annotations correspond to various alloy compositions, such as 6005A, 6061, 6060, 6082, and Mg5Si6, indicating their respective mechanical strength and extrudability properties. The Mg2Si solubility limit is highlighted, showing the maximum concentration of Mg2Si that can be dissolved in the alloy without precipitation.
# CHEMICAL COMPOSITION AND EFFECT (QUALITATIVE)

<table>
<thead>
<tr>
<th></th>
<th>Strength</th>
<th>Extrudability</th>
<th>Corrosion Resistant</th>
<th>Thermal Stability</th>
<th>Crash</th>
</tr>
</thead>
<tbody>
<tr>
<td>Si</td>
<td>↑↑↑*</td>
<td>↓↓</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mg</td>
<td>↑↑↑*</td>
<td>↓↓</td>
<td></td>
<td>↑</td>
<td>↑↑*</td>
</tr>
<tr>
<td>Fe</td>
<td>↓</td>
<td>↓</td>
<td>↓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cu</td>
<td>↑↑</td>
<td>↓↓</td>
<td>→**</td>
<td>↑↑</td>
<td></td>
</tr>
<tr>
<td>Mn</td>
<td>↑**</td>
<td>↓↓↓</td>
<td>↑↑</td>
<td></td>
<td>↑</td>
</tr>
<tr>
<td>Cr</td>
<td>↑*</td>
<td>↓↓↓</td>
<td>↑↑</td>
<td></td>
<td>↑</td>
</tr>
</tbody>
</table>

* Mg/Si ratio
** If process is in control
LOW YIELD ALLOY

<table>
<thead>
<tr>
<th>Rp₀₂</th>
<th>Rm</th>
<th>A₅%</th>
</tr>
</thead>
<tbody>
<tr>
<td>220±20 MPa</td>
<td>≥ 225 MPa</td>
<td>≥ 11%</td>
</tr>
</tbody>
</table>

- Standard 6063 meets requirements

Excellent crushability

Excellent corrosion resistance

Thermal stability

*REF. = T6/T7; PAINT BAKE = 1H AT 205°C; END OF LIFE = 1000H AT 150°C
MEDIUM YIELD ALLOY

- Standard 6005 does not meet requirements

<table>
<thead>
<tr>
<th>Rp0.2</th>
<th>Rm</th>
<th>A5%</th>
</tr>
</thead>
<tbody>
<tr>
<td>260±20 MPa</td>
<td>≥ 260 MPa</td>
<td>≥ 10%</td>
</tr>
</tbody>
</table>

*REF. = T6/T7; PAINT BAKE = 1H AT 205°C; END OF LIFE = 1000H AT 150°C

Poor crushability

Poor corrosion resistance

Thermal stability

*REF. = T6/T7; PAINT BAKE = 1H AT 205°C; END OF LIFE = 1000H AT 150°C
MEDIUM YIELD ALLOY

- New alloy developed to meet requirements
- Thermally stable at 150°C

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Excellent crushability

Excellent corrosion resistance

Thermal stability

*REF.= T6/T7; PAINT BAKE = 1H AT 205°C; END OF LIFE = 1000H AT 150°C
HIGH YIELD ALLOY

Rp0.2 | Rm | A5%
---|---|---
300± 20 MPa | ≥ 305 MPa | ≥ 10%

- New alloy developed to meet requirements
- Thermally stable at 150°C

Excellent crushability

Excellent corrosion resistance

Thermal stability

*REF. = T6/T7; PAINT BAKE = 1H AT 205°C; END OF LIFE = 1000H AT 150°C
DEVELOPING TOGETHER

Your contacts:

Jörg Brunhorn
Product Manager Automotive
Phone: +45 73 93 94 06
Email: joerg.brunhorn@sapagroup.com

Mette Boye Sørensen
Process Manager
Phone: +45 73 93 93 55
Email: mette.b.sorensen@sapagroup.com

OEM Crash Standards

- **DBL4919** – Qualified
  - For DBL4919.10, .20, .30 and .40
- **TL116** – Under qualification
  - N/C20, N/C24 – under qualification
  - N/C28 – March 2014
  - N/C32 – Under development
- **WS** – Under qualification
  - WS02002A/B – Under qualification
  - WS02003A/B – End 2014
  - WS02009A – Under development